PHONEMICS OF OLD TAMIL

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To my dear friend

P. JAGANNATHAN

with

esteem and affection

in

sweet memory of happy days

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PREFACE

Fascinated by the outstanding developments in modern theoretical Phonemics mainly due to such pioneers in this noble branch of linguistic science as VACHEK[1] of Prague and W. Freeman TWADDELL[2] of America, I was tempted to determine the status of the interesting phoneme known as the *Āytam* in Old Tamil nearly a decade ago from the point of view of this new methodology. The present Monograph owes its origin to this.

Now the question arises — "What is meant by 'Phoneme'?" A small number of typical unit-sounds having themselves no meaning are arranged in a certain fixed way in each meaningful form of every language. These signals are generally called phonemes and they go to make up the meaningful forms that are uttered.[3] Such a usual definition of 'phoneme' leads to

1. Cf. VACHEK, One aspect of the Phoneme Theory, *Proceed. of the Second Interna. Congr. of Phonetic Sciences*, Cambridge at the University Press, 1936, pp. 33-40.

2. Cf. W. F. TWADDELL, On Defining the Phoneme, *Language Monographs*, No. 16, Baltimore, 1935.

3. Cf. L. BLOOMFIELD, Linguistic Aspects of Science, *International Encyclopaedia of Unified Science*, Vol. 1, No. 4, 1939, p. 21.

I had occasion to discuss phoneme with Prof. Siddheshwar VARMA (of Jammu, Kashmir) and Prof. Daniel JONES (Dept. of Phonetics, University College, London). At that time Prof. JONES made the following remarks, in a letter dated 17th March 1947 to Prof. VARMA, which are relevent to our discussion here:—

"The phoneme does not seem to me to be *necessarily* connected with meaning, though it is in fact generally connected with it. I mean that pairs of phonemes are always *capable* of distinguishing words, though they do not always actually do so. It has never seemed to me advisable to bring meaning into the definition of the phoneme."

Cf. also L. BLOOMFIELD, A Set of Postulates for the Science of Language, *Language* Vol. 2, 1926, p. 157.

L. BLOOMFIELD, Review of Eduard HERMANN, *Lautgesetz und Analogie, Language*, Vol. 8, 1932, p. 222.

Vide, Daniel JONES, Some Thoughts on the Phoneme, *Transactions of the Philological Society*, 1944, pp. 121 ff.

Cf. further, C. F. VOEGELIN, A Sample of Technical Terms in Linguistics, *Interna. Journ. of American Linguistics*, Vol. 14, p. 120, (1948).

Any careful reader of this Monograph will see that my theory of the alpha-phoneme addresses itself to the 'conceptual' ('formless', more precisely speaking; ordinarily, even the 'concept' is still embodied with a 'form', however subtle it is. [Cf. in this connection L. BLOOMFIELD's criticism of Karl PEARSON's *Grammar of Science*, 2nd edition, London, 1900; 3rd edition Vol. I, 1911, in L. BLOOMFIELD's review of Wilhelm HAVERS's *Handbuch der erklärenden Syntax, Language*, Vol. 10, 1934, p. 34, footnote 2. BLOOMFIELD speaking here of Karl PEARSON's work observes "It is a classical treatise, which loses much, however, by ignoring linguistic values; thus, Pearson leaves otherwise simple things in a fog by saying 'conceptual' where the linguist would say 'verbal'."] I owe this 'aesthetic' suggestion to Śri. B. CHAITANYA DEVA).

a succession of several questions, and the attempts to answer some of them, at any rate, constitute the theoretical framework of modern phonemics.

One important question is whether phoneme grouping is, or is *not*, a product of acoustic analysis.[4] More or less following W. F. TWADDELL in this matter, I made my maiden attempt, so to say, to define the Phonemic status of the *Āytam* as early as in 1941. But very soon I discovered this *Āytam*-phenomenon to be extraordinarily interesting. I found also a little later that this *Āytam* or rather more precisely speaking, the *Āytam-phenomenon* could be a strong pointer to the redefinition of vowels and consonants in human speech.[5]

At the time when my interest began to be aroused in theoretical phonemics, I found myself to be on the very threshold of the development of a particularly intriguing situation in theoretical phonetics as well, however unrecognised, at any rate explicitly, by earlier workers.

Helmholtzian conception, SCRIPTURES's qualitative equations and the experimental evidence brought forward by TANAKADATE (Cf. footnote 87),

The 'formless' here corresponds to *langue* and the 'form' corresponds to *parole*. (For the conception of *langue* and *parole* according to my predecessors in the field of Phonemics see VACHEK, *op. cit.*, p. 35.)

Tolkāppiyar's genius consists in suggesting this 'formless' through 'form' (his *Kuṟṟiyalikaram*; *Kuṟṟiyalukaram* and particularly the *Āytam*; see especially *Tol., Eḻut.*, sūtra 101).

The *alpha-phoneme* concept is developed from out of this beautiful suggestion coupled with "a generalisation [Laboratory Phonetics furnishes] developed inductively from an adequate (or, can the situation be more properly described in the very nature of things, extremely *inadequate* even at that purely empirical level?) body of qualitative pointer-readings" (cf. W. F. TWADDELL, On Defining the Phoneme, *op. cit.*, p. 37), thus elevating Phonetic science to a deductive level.

Martin JOHNSON while discussing 'Significance of Interval Invariance', in his 'Analysis of the Lorentz-Einstein Interlocking of Time- and Space-observation', (*Time, Knowledge and the Nebulae*, an introduction to the meanings of Time in physics, astronomy, and philosophy, and the relativities of Einstein and of Milne, Faber & Faber Ltd., 24, Russell Square, London, 1946, Part II, Ch. I, 1, p. 53), refers to his "view that knowledge as communicable might well be non-existent without the constancy of a signal velocity of some kind."

The alpha-phonoid (cf. footnotes 93 and 94) is the "form" which is given precisely the same meaning as "constancy of c expressed as 'invariance' of the four-dimensional 'interval'", (Martin JOHNSON, *ibid.*, p. 52), suggesting the "formless" (i.e. the alpha-phoneme) which is wholly subjective (cf. footnotes 71 and 77) and, therefore, makes our ultimate knowledge of speech-universe communicable, being an arbitrary signal "for idealised signalling as a novelty in being an *a priori* convention, an 'agreed number' independent of the empirical." (Martin JOHNSON, *Ibid.*, p. 118).

4. Cf. W. F. TWADDELL, Miscellanea, Answers to ANDRADE's questions, *Language*, Vol. 12, 294.

5. Cf. C. R. SANKARAN, On Defining the Alpha-Phoneme, *Current Science*, Vol. 13, 1944, pp. 11-12.

G. Oscar RUSSELL and others had all been brought to a new peak of opposition. The situation obviously set the stage for the *alpha-phoneme theory* as a generalised *Āytam-phenomenon.*

In my very first paper itself on the subject of the *Āytam*-phenomenon in Old Tamil,[6] I demonstrated the possibility of defining the *Āytam* by 'section-idea' in the familiar manner of Dedekind's postulate. My development of the theory of the generalised *Āytam*-phenomenon in human speech starts from exceedingly elementary considerations. These form the various bricks of the construction. My contention has been throughout this period of a decade that a development of certain altogether fresh ideas is not only possible but also is logically obvious and inevitable, granted the initial idea. From a very simple view of the physical situation of human speech, the purely theoretical approach to the whole problem is captivating. It is more than my conviction that any one with sufficient faith in the usefulness and essential truthfulness of the initial idea would have travelled a similar path as I seemed to have done in all my investigations throughout. It is as it were uncovering an already existing situation. I have ever since felt an urge to impart at least a fraction of the excitement and exhilaration which has been attending the working out of a fresh line of invesigations, as the adventure is very much fascinating. It is hoped that the theoretical background provided in the present Monograph will achieve this objective to some small extent at least.

Here a word may be felt necessary to make my position regarding the meaning of the investigations concerning the *Āytam*-phenomenon quite clear. First, I was able to show that the so-called *Āytam* in Old Tamil made its appearance between a vowel and one of the following six consonants: *k, c, ṭ, t, p* and *ṟ*. It is this conception alone which led me further on to make a wider generalisation of the *Āytam*-phenomenon.[7] My construction is an auxiliary idea for the purpose of visualisation. No physical meaning is ascribed to it. Nor does the original formulation of the theory involve any idea concerning the ultimate nature of the physical, physiological and psychological *causes* of the speech phenomena themselves. It has been only a representative idea.

L. BLOOMFIELD[8] thought that "any form of the language is completely and rigidly definable as a linear or quasi-linear sequence of phonemes." I differ from him. It appears to me on the contrary that the combination of phonemes (sometimes, at any rate) is of a definite composite character.

6. C. R. SANKARAN and N. K. SRINIVASAN, The Phonemic Variants of *Āytam* in Old Tamil, BDCRI, Vol. 2, 1941, pp. 343-50.

7. C. R. SANKARAN, An Introduction to the Study of Old Tamil Phonemics, BDCRI, Vol. 8, 1947, p. 90. (Hereafter cited as *Introduction*).

8. L. BLOOMFIELD, *Linguistic Aspects of Science*, p. 24.

Tolkāppiyar's recognition of *Kuṟṟiyalikaram, Kuṟṟiyalukaram* and the *Āytam* points towards this. There is no linear arrangement in a configuration of vowel *plus Āytam plus* consonant. The term *plus* used here should by no means mislead the reader of this Monograph to think that the combination of the *three* is *mere addition.* The combination here is like a very general type of such a combination in mathematics (that of operator and operand, selective operators being a particular case).[9]

If φ represents the function of the phoneme, φ (*f*) may have different speech-forms and meanings which are determined by coordinates in time and space, i.e.,

$$\varphi = \psi\ (f, t, s)$$

and $\dfrac{\partial^2\psi}{\partial s^2} \neq 0,\ \dfrac{\partial^2\psi}{\partial f^2} \neq 0,$ and $\dfrac{\partial^2\psi}{\partial t^2} \neq 0.$[10]

Now it is my hope that this Monograph will also be useful particularly to the field worker who operates with the living Dravidian dialects (See footnote 55). For, such a one is in dire need of a work which will take him into the intricate phonemic structure of Old Tamil.[10a] An insight into this structure is provided by *Tolkāppiyam,* the oldest Tamil descriptive grammar, from which a modern student of phonemics can easily rediscover many a concept that is coming into vogue today.

Phonemics is an essential and an indispensable discipline to all linguisticians alike — be they comparativists or descriptivists. Above all, there is a real need now for the presentation of my investigations on Old Tamil Phonemics since it is through these investigations alone that it has been felt possible to effect a harmonisation of Phonemics with Experimental (?) Phonetics,

9. Cf. EDDINGTON, *The Philosophy of Physical Science,* Cambridge at the University Press, 1939, p. 26. (cf. Footnote 13a).

The non-additive relation here is parallel to the important non-additive relations in physics as pointed out by EINSTEIN in connection with his rejection of the familiar formula for the addition of vectors (compounding of velocities for light; cf. Albert EINSTEIN, *The Meaning of Relativity,* Methuen and Co., Ltd., London, 4th Edition, 1950, p. 35, on the addition theorem for velocities) and also the non-additive and organic social relations as pointed out by KORZYBSKI. (Cf. Oliver L. REISER, Historical-Cultural Significance of Non-Aristotelian Movement and the Methodological Contributions of Korzybski, *Papers from the Second American Congress on General Semantics,* Institute of General Semantics, Chicago, 1943, p. 8).

10. C. R. SANKARAN and G. S. GAI, An Attempt at Demonstration of the Non-Numerical Mathematical Discourse of Linguistics, JGJRI, Vol. 2, Allahabad, 1944, p. 179.

10a. Field techniques in Descriptive Linguistics are ably discussed in an article bearing that title by Eugene NIDA in the *International Journal of American Linguistics,* Vol. 13, 1947, pp. 138-46.

the study of the tell-tale *sūtras* in *Tolkāppiyam* which describe the *Āytam*- or rather, as we can more legitimately interpret, or extend the concept as the *Āytam*- Phenomenon being solely responsible for an attempt at such a harmonisation.

It is difficult to believe in a Monograph of this kind that one has entirely avoided errors. I trust however, that there are none of a serious nature. My labours here will be amply repaid if this work which is ushered now as the first of the Dravidic studies from the Department of Dravidian Philology, Deccan College Post-Graduate and Research Institute, Poona, succeeds in stimulating further interest and research both in theoretical Phonemics and in its varied applications in different aspects, particularly to the entire Dravidian field.

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16th February, 1950.

C. R. SANKARAN.

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I must also acknowledge my indebtedness to the entire Library staff of the Institute for the continued enjoyment of many special Library facilities such as the Inter-Library Loan, given to me ungrudgingly all this period.

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I am very much obliged to Sri. B. CHAITANYA DEVA in particular for undertaking the most exacting and arduous task of preparing the card-index of *Tolkāppiyam Sūtras.*

Here I hasten to record also my deep sense of appreciation to Sri. P. C. GANESHSUNDARAM for his magnificent patience in preparing elaborate and extensive subject and name indexes.

Acknowledgements to the various works referred to in this monograph are made in many places and a Select Bibliography is appended at the end.

Figures 3-8 and 9-14 from G. Oscar RUSSELL's "Mechanism of Speech" (J A S A, Vol. 1, pp. 89 and 90) are reproduced here with the kind permission of the author and the courtesy of the editors of the Journal of the Acoustical Society of America.

I am indebted to Prof. A. GEMELLI, Milan, Italy, for his kind permission to produce here an oscillogram of the Chinese phrase "Siao chung kno tzu yu szu sheng", which he sent to me over a year ago.

I am thankful to Sk. Zainuddin Dawood ANSARI of the Archaeological Department of the Institute for rendering me photographic assistance.

I am indebted to the G. S. Press, Madras, for the neat execution of this work.

11. Scientific Assistant of the Phonetics Laboratory of the Institute.

Last but not least, I owe much to B. K. HUMBRE (or BABU, as he is endearingly called by all of us!), the faithful attender of the Phonetics Laboratory but for whose loyalty and devotion to his mechanical work most efficiently executed, it is no exaggeration to say that I would have found it almost impossible to pursue my investigations.

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TRANSLITERATION

Generally the ordinary Roman transliteration method alone has been mainly followed in this Monograph.

The International Phonetic Transcription has been only used sparingly when the symbols of the International Phonetic Transcription are enclosed within rectangular brackets. Otherwise the system of transliteration throughout here is the adoption of that of the Royal Asiatic Society with the modifications indicated below :—

Description of Special Symbols :—

ṉ (ன்) alveolar nasal.

ṟ (ற்) The cerebral (or retroflex) ṟ of Tamil-Malayālam group ; trilled to a greater extent than the post alveolar ṟ (ற் of the Tamil script and റ of the Malayālam script).

ṟṟ (ற்ற்) The long alveolar plosive of the Tamil-Malayālam group (with or without any such ṟ sound which is usually incorporated in the evaluation of literary Tamil. ற்ற் of the Tamil and ററ of the Malayālam scripts.)

ḻ (ழ்) voiceless retroflex lateral. It is the retroflex continuant of the Tamil-Malayālam group (ழ் of the Tamil and ഴ of the Malayālam scripts). According to the empirical phonetician, it is " a frictionless continuant having an obscure unrounded back-vowel quality. ḻ is made by drawing back the whole tongue, and spreading the blade laterally, making it thick, short and blunt, so to speak, so that it approaches the middle of the hard palate. The result is a very retracted liquid sort of ṟ-sound."[11a]

The Non-Linear Phonemes :—

i̇ (இ̇) *Kuṟṟiyalikaram.*

u̇ (உ̇) *Kuṟṟiyalukaram.*

The empirical phonetician usually describes it as " the unrounded (or lip-spread) variety of *u* appearing in final position in Tamil and in [the so-called] 'vulgar' or colloquial Malayālam dialects." (Cited from A. C. SEKHAR's unpublished Ph.D. Thesis).

ஃ (ஃ) The so-called *Āytam.*

11a. Cf. J. R. FIRTH, A Short Outline of Tamil Pronunciation. Appendix to ARDEN's *Tamil Grammar,* p. xvi.

INTRODUCTION

In my earlier paper[12] only a few traces of scientific phonemic analysis of Old Tamil in *Tolkāppiyam* were discussed. The object of the present Monograph is to go further into greater detail of phonemic analysis of Old Tamil exploiting the oldest descriptive grammar of Tamil for this purpose.

Phonemes are significant classes of speech-sounds, in terms of which alone an organisation of the descriptive study of speech sounds of any language is possible. We meet with the accurate description of phonemes of the Old Tamil language, built apparently on the results of phonetic study, in *Tolkāppiyam,* which is the oldest descriptive Tamil grammar. Such an emphasis on the pattern inherent in the sounds of the language of study, and the attempt to establish, on the basis of their occurrence and distribution, the types of sounds which must have been significant in distinguishing the meaning of words is not met with even in the *Aṣṭādhyāyi* of Pāṇini.[13]

Tolkāppiyam, for instance, deals with *defective phonemes* some of which appear only initially while some others only finally.

We also learn from this great work a good deal about the allophones or positional variants (viz., members of a phoneme which is itself a *class* of speech-sounds) whose *variant character* is determined by the neighbouring phonemes.

It is quite obvious that the analyst who operates on the spoken language has certain clear-cut advantages. For, he can himself hear and record the fine details of articulation (as far, of course, as the ear can judge!)[13a] and

12. C. R. SANKARAN, *Introduction,* pp. 87-96.

13. *Ibid.* p. 87.

13a. It has already been recognised by earlier workers in the field of Physical Phonetics that the so-called subjective method of analysis (by 'subjective' here is meant only judgement of spoken sounds by the ear and not the more subtle sense of an 'inner *transcendental* experience' [Cf. E. A. MILNE, *Nature,* Vol. 163, 1949, p. 856; also H. S. RUSE, *Nature,* Vol. 163, 1949, p. 932] involved in the alpha-phoneme theory; cf. footnote 71) of composite sounds such as the human voice, however, apparently simple and undoubtedly useful too in certain restricted instances, is inadequate when greater details are required and that this end is attained only by what has been hitherto usually recognised as the objective method of analysis of the wave form of the sound which is recorded by means of optical, mechanical, or electrical contrivances. (Cf. Takurô TAMARU, Jûichi OBATA and Takehiko TESIMA, A6·12—Physico-Phonetical Studies of the Sounds Spoken in the Various Districts of Japan, *Fifth Pacific Science Congress,* p. 2241).

But clearly this is not all that can be said in regard to this matter. For, to anyone who carefully follows the arguments developed in this Monograph it will be evident that to understand speech-phenomena at a deeper *conceptual* level, both the so-called *subjective* and the *objective* methods of study ought to be combined more than as a *mere addition* of the two methods (cf. footnote 9).

can have even recourse to a native speaker in case of doubt on any point. But there are undoubtedly very serious limitations to an attempt at the phonemic analysis of a language which is no longer spoken.

These limitations, doubtless, are the available scanty evidence (or, more often, as it truly happens, even the much more annoying complete absence of any evidence!), and the uncertainties due to imperfect orthographical representation and incomplete attestation — uncertainties which one cannot, without much difficulty, guard oneself against. However, it is possible to overcome these limitations to a considerable extent by means of inferences based upon comparative evidence, internal (from the language itself, however scanty the direct evidence) or external (from related dialects or languages) and on historical evidence (earlier[14] or later stages of the language).

No one would deny the necessity for a descriptive analysis of the earlier stage, even some of whose traces in certain forms are no longer present in a language spoken today, for such an analysis alone would complete the picture of historical development, not only of individual sounds and words, but of the pattern of the language as a whole.

The author of *Tolkāppiyam* by the rare insight he has displayed in his work, in regard to his treatment of the Old Tamil spoken in his time[15] has made the work of any modern analyst operating on the Old Tamil considerably easy.

In the present Monograph, we are mainly concerned with the *linear* and the *non-linear* 'phoneme-combinations' in Old Tamil as revealed by some of the tell-tale sūtras of *Tolkāppiyam* both in the sections dealing with *phonology* (*Eḻuttatikāram*) and *morphology* (*Collatikāram*).

14. Even in spite of the paucity of direct evidence in this connection, the rigorous reconstruction methods can be used most effectively here.

Cf. G. Bonfante, On Reconstruction and Linguistic Method, *Word*, Vol. 1, 1945, pp. 83-94; 132-161, *Word*, Vol. 2, 1946, pp. 155-6.

For further light on the methodological questions involved in this problem, see G. S. Lane, On the Present State of Indo-European Linguistics, Language, Vol. 25, 1949, pp. 333-42 (especially 337-38).

15. Cf. *Introduction*, p. 88.

Linear and Non-Linear Phoneme Combinations in Old Tamil

While speaking about the so-called origin of the *sound-classes,* although the author of *Tolkāppiyam* appears to follow on the surface the Sanskrit grammarians, it redounds to his credit that he does not expatiate on the so-called *Mūrdhanya* sounds. For, in accordance with modern scientific Phonetics there is no sound produced ' in the head '.[16]

In the first *sūtra* of *Eḻuttatikāram,* Tolkāppiyar lists the linear phonemes, i.e., phonemes occurring one after the other in the stream of articulations.[17]

1. *Enumeration of Phonemes in Old Tamil :*

Eḻutteṉappaṭupa
Akaramuta
Nakara viṟuvāy muppaஃteṉpa
Cārntu varaṉ marapiṉ mūṉṟalaṅkaṭaiyē.

எழுத்தெனப் படுப
அகரமுத னகரவிறுவாய் முப்பஃதென்ப
சார்ந்து வரன் மரபின் மூன்றலங்கடையே.

" The thirty sound-classes (phonemes) from *a* to *ṉ* except the three *non-linear phonemes* are termed *Eḻuttu* ".

The very fact that in the first *sūtra* of *Tolkāppiyam, Eḻuttatikāram,* itself we meet with the statement that there are only thirty linear phonemes in Old Tamil, nullifies Caldwell's unwarranted assumption of the convertibility of surds and sonants in ancient Tamil.[18] It can be also inferred that *Tolkāppiyar* realised that the differences between the vowels **[i]** and **[I]**, **[u]** and **[U]** be marked in transcription by the use of distinct symbols, and not merely by the use of a mark of length, for otherwise he would not have stated that there existed thirty phonemes (12 vowels and 18 consonants), but would

16. Walter-Ripman, *Elements of Phonetics,* p. 14 (Dent), 1932.

17. For Trubetzkoy's conception of *linear* and *non-linear* contrasts see his *Grundzüge der Phonologie,* (*Travaux du Cercle Linguistique de Prague,* 7 Prague 1939). Cf. also Z. S. Harris, *Language,* Vol. 17, p. 347, 1941.

18. Cf. Caldwell, *Comparative Grammar of Dravidian Languages,* pp. 22-23. C. R. Sankaran and A. C. Sekhar, Middle Dravidian Morphology, BDCRI, 6, p. 159, 1946 ; see also P. S. Subrahmanya Śastri, *Tolkāppiyam Eḻuttatikāram* with an elaborate (Tamil) commentary p. 5, 1937. Vide *Introduction,* p. 89.

have said instead that there existed only 25 phonemes (7 vowels and 18 consonants). It is significant to find a striking agreement in this between *Tolkāppiyar* and the empirical findings of the modern investigator, revealing thereby *Tolkāppiyar*'s very rare insight.[19]

2. *Organs of Articulation :*

It is to be noted specially that the author of the oldest Tamil grammar departs from the view of the traditional grammarians and appears to subscribe to the modern accepted notion that the physiological characteristic of an act of speech is that it occurs in a specific locus of the human body, the respiratory tract and the mouth, rarely (as in esophagal speech) the stomach. If a cross-section be taken of the stream of speech at a given moment, each of the organs concerned is seen to have at that moment a specific functional status; a moment later the situation would be different. Obviously the different organs do not change from one functional status to another always at the same moment; the statuses overlap.[20]

Tolkāppiyam Eḻuttatikāram Piṟappiyal (Chapter 3) deals with the so-called origin of the speech-sounds with reference to the organs of articulation:—

Unti mutalā muntuvaḻi tōṉṟit
Talaiyiṉu miṭaṟṟiṉu neñciṉu nilaiip
Pallu mitaḻu nāvu mūkku
Maṇṇamu muḻappaṭa veṇmuṟai nilaiyā
Ṉuṟuppuṟ ṟamaiya neṟippaṭa nāṭi
Yellā veḻuttuñ colluṅ kālaip
Piṟappiṉākkam vēṟuvēṟiyala
Tiṟappaṭat teriyuṅ kāṭci yāṉa.

உந்தி முதலா முந்துவளி தோன்றித்
தலையினு மிடற்றினு நெஞ்சினு நிலைஇப்
பல்லு மிதழு நாவு மூக்கும்
அண்ணமு முளப்பட வெண்முறை நிலையான்
உறுப்புற் றமைய நெறிப்பட நாடி
எல்லா வெழுத்துஞ் சொல்லுங் காலைப்
பிறப்பி னுக்கம் வேறுவே றியல
திறப்படத் தெரியுங் காட்சி யான.

"It will be evident on careful observation that all the sounds (in the Tamil language) are but the results of the modifications which the air under-

19. W. N. LOCKE and R. M. S. HEFFNER, Notes on the Length of Vowels (II), *American Speech*, Vol. 15, 1940, p. 79.
20. Cf. *Introduction*, p. 89.

PLATE I

X-ray Photographs of G. O. Russell

"American English. Young Lady from Central Ohio. Do these tongue positions substantiate a one, two or three cavity-tone theory? What causes a supposed 2 resonator effect in the vowel of Fig. 6 and not in Fig. 8 or Fig. 11?"

"Note: But little difference between the tongue position for the vowels in *the* and *pup* was found."

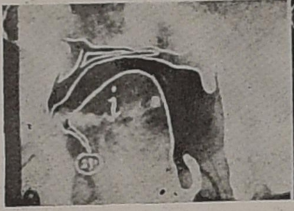


FIG. 3
Vowel i (*ee in peep*).

FIG. 4
Vowel I (*-i-in pip*).

FIG. 5
Vowel e (*a-e in pape*).

FIG. 6
Vowel ε (*-e-in pep*).

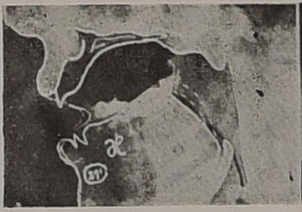


FIG. 7
Vowel æ (*-a-in pap*).

FIG. 8
Vowel a (*an in bah or balm*).

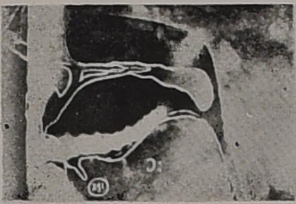


FIG. 9
Vowel ɔ : (*aw in maw or bawl*).

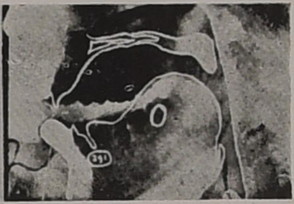


FIG. 10
Vowel o (*o-e in pope*).

FIG. 11
Vowel u (*oo in boob or rune*).

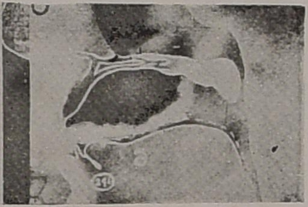


FIG. 12
Vowel ə (*uh in idea, the or pup*).

FIG. 13
Vowel U (*oo in foot*).

FIG. 14
Vowel y (*ü in müde*).
with lip rounding.

Reproduced from G. Oscar Russell, "The Mechanism of Speech", J.A.S.A., Vol. 1, (1929), pp. 89 and 90, with the kind permission of the author and with the courtesy of the editors of the Journal.

goes in starting from navel, and passing through light parts [?] — chest, neck, head, tongue, hard palate, teeth, lips and nose".[21]

3. *Organs of Production and Places of Articulation* :—

In this connection it may be noted that modern commentators (or rather, interpreters !) of *Tolkāppiyam* have often been using the irresponsible expression 'organs of production' for obviously the more correct 'places of articulation'.

It may be observed here that even to speak of the 'places of articulation' is scientifically inaccurate. That was why G. Oscar RUSSELL, the great pioneer of X-ray investigations as applied to speech, was, in his "Speech and Voice",[22] led on to ascertain the forms and sizes of human speech cavities as also the position and relative relationship of the various physiological organs which actually appear when producing certain speaking resultants.[23] The form of the vocal cavity is regulated by movements of the muscles which are not and never can be still for an instant. There can be only vowel movements and never vowel positions.[24]

4. *Vowel Quality Differences* :—

Regarding the vowel quality differences it will be interesting to note here what G. Oscar RUSSELL has to say :—[25]

" ......I am frankly surprised that none of those who have studied the vowel should have ascribed to surfaces and their influence any of the qualities manifest in vowels.... In his *Science of Musical Sounds* he [D. C. MILLER] reports his experiments with an organ pipe having double-walls between which he could pour water, and noted that during the filling the 'quality changed, conspicuously thirty or forty times', *even though the dimensions of the 'resonance' cavity itself were kept constant.*[26]

21. P. S. Subrahmanya ŚASTRI, *Tolkāppiyam Eḻuttatikāram Piṟappiyal* sūtra 83 *Madras Oriental Series*, No. 3, 1930, p. 12.

The English translations of the *Sūtras* from *Tolkāppiyam Eḻuttatikāram* given here follow only on the bare surface this work. Any divergencies from his translations, for obvious scientific reasons, where necessary, are indicated by the adoption of various suitable devices such as the use of a circular bracket within a rectangular bracket. See for example *Introduction*, p. 90.

22. New York, Macmillan & Co., 1931, p. 4.

23. See *Introduction*, p. 89; vide C. F. HOCKETT, System of Descriptive Phonology, *Language*, Vol. 18, 1943, pp. 1 and 5.

24. Cf. E. W. SCRIPTURE, The Nature of the Vowels, ANPE, Tome 7, 1932, p. 68.

Cf. also, STETSON's view that speech is rather a set of movements made audible than a set of sounds produced by movements. Vide STETSON, Motor Phonetics ANPE, Tome 3, 1928, p. 29.

25. Vide G. O. RUSSELL, The Mechanism of Speech, JASA, Vol. 1, p. 93, 1929-30.

26. Italics mine.

"If surfaces create quality differences between musical instruments, why should they not do likewise in speech and voice? Why should they not be involved in creating vowel quality differences?

"Is it not possible that this is the physiological reason for the creation of that long soft surfaced chimney through which the sound is forced to escape for the vowel ɔ ('aw' as in 'bawl'), and for the difference between this vowel and that of the vowel *a* ('ah')? These are soft surfaces in that back throat neighbourhood and soft surfaces must inevitably either muffle the sound, or mellow its quality, especially where the tube is so narrow in relationship to the total area. If they were hard, the opposite effect might be expected, giving a metallic tonal quality of sound somewhat analogous to that produced by extremely narrow organ pipes.

"One might, therefore, expect by reason of the surface involvement, a distinct difference between the vowel ɔ ('aw' as in 'bawl'), in Fig. 9 and the *i* ('ee' as in 'peep'), Fig. 3.[26a] (See Plate I).

"Both of them show a long narrow tube joining on to a relatively large bellied cavity. For the first, the long neck is created between soft surfaces, and for the last, against hard surfaces. Otherwise they would both be narrow and long, and if manifest in organ pipes would be expected to produce high-pitched characteristic frequencies.

(p. 94) "......Of course, there can be no question as to the presence of the dual cavity tone in the speech curve for the I (as in 'pip') ...... The question is whether it would have been found in the recorded speech curve whose tongue position shown by the X-ray photograph in Fig. 4 we are now considering. *In this case the actual position taken fails to show the two cavities required to produce the two cavity tones.*[27]

(p. 99) "A simple experiment will prove to any one that *it is not necessary to arch the tongue up against the hard palate, thus forming a narrow, bottle neck-like tube, in order to articulate a perfectly good I* (as in 'pip').[28] A little practice will shortly demonstrate to everybody's satisfaction that it is possible .... to press the front part of the tongue down flat in the mouth with your index finger, and yet articulate an unmistakable 'pip' and while maintaining the same position one can make the transition to 'pep' without difficulty. All of which goes to prove conclusively to any unbiased mind that

26a. The Original paragraph of RUSSELL is split, here into two paragraphs for obvious reasons.

27. Italics mine.

28. Italics mine.

the traditional modification in the front buccal cavity, and tongue position is not necessary in order to produce this vowel quality difference."[29]

Again, referring to Sir Richard PAGET,[30] RUSSELL[30a] continues, "First, Paget can cup his hands into a single cavity with a reed between the thumbs, and make them say as cleverly as any artificial reproduction I ever heard :

"'Laila I love you'
" (laila ai ləv ju)

and

"'Hello London are you there'
" (ɛlo lɔndɔn a ju ðɛ)

"What conclusion are we to draw? He (PAGET) uses but a single cavity. Does that result indicate a two cavity resonance as necessary to create the quality distinction in any of those vowels? ......

"Second, when I asked Sir Richard to raise the pitch of his reed, corresponding to the voice of glottal tone, during the production of his two-tone resonator vowel ɛ (eh) *the quality changed without any alteration in the capacity of the Resonator*,[31] to that of the vowel *i* (peep), or at best something like that of *I* (pip)".

Of late the old phonetic theories have been proved erroneous and recently noteworthy advances have been made in phonetic science. The attention of the reader of this Monograph is particularly called to the following passage, which is a summary of the article 'Dynamic vs. Static Phonetics', by James L. BARKER.[32]

"Phonetics has been based on certain theories; namely, that minute differences of tongue position are chiefly responsible for the differences in pronunciation from language to language, that how these positions are reached and left is of no consequence because the effort to expel the breath is continuous within the syllable, and the shifts in position are predetermined and made in the same manner in all languages.

"All the better known phoneticians have based their work on these generally accepted theories, and yet it would seem that these theories of change in position and constant expulsion of breath are wholly false.

29. Italics mine.

30. Artificial Vowels, *Proc. Roy. Soc.* Series A, Vol. 102, (1923), pp. 755-62. Readers of this Monograph may with benefit study this important paper of PAGET in entirety, *ibid.*, pp. 752-765.

30a. RUSSELL, *op. cit.*, p. 105.

31. Italics mine.

32. JSD, Vol. 5, 1940, pp. 153-83.

"*Though it is true that positions are important, there is no one and one only position for any sound, since there are many compensations in position — the tongue does not touch in the same position if the teeth are closed together as it does if the teeth are far apart.*[33]

"English, French, German, Italian, etc., *t, d, l* and *n* can be pronounced *with any physiologically possible place of tongue-palate contact.*[34] Hence, minute differences in tongue position cannot be responsible for brogue differences.

"Any comparative experiment shows that *the transitions from sound to sound are not made in the same way in French and English, German and English, or in English and any other language.*[35] Moreover, the way the transition is made is highly characteristic of the language,

"Experiments show that the expulsion of the breath is usually continuous in English within the syllable but not continuous in German, French, Italian, Spanish, etc.

"For the theory of static positions there should be substituted a theory of position (and direction [?]) of movement in relation to breath control. *Minute differences in position,* when they occur, *are the effects of the differences in mechanism from language to language and not the cause of the distinctive brogue differences.*[36]

"The old theory of static phonetics leaves all of the characteristic brogue peculiarities unexplained, such as:

"In English, slurred vowels, diphthongs, drawling, and in the English pronunciation of French, the presence of nasal consonants after nasal vowels, short and insufficiently voiced consonants; in the English pronunciation of Italian and French failure to pronounce double consonants correctly. In the Romance-Slav pronunciation of English it fails to explain the vowel-like sounds after stop consonants, too distinct vowels, lack of proper diphthongs, etc. All known differences are explained and corrected by dynamic phonetics, making use of the theory of position and direction of movement in relation to breath control."

5. *The Effect of Soft Walls of Mouth Cavities :—*

In this connection, the effect of the soft-walls of the mouth cavities as affecting the resonant characteristics of the vowels is worthy of consideration

33. Italics mine.
34. Italics mine.
35. Italics mine.
36. Italics mine.

here. J. C. COTTON, in his paper, 'Resonance in Soft-walled Cylinders'[37] writes:—

"The mathematical treatment of resonance as displayed by enclosed volumes of gas usually begins with certain simplifying assumptions one of which is that the walls of the resonating cavities be considered perfectly rigid...... But if the resonant gas volume be enclosed in a soft flesh-walled cavity, for instance, considerable deviation from the theory is to be expected.......

"......Helmholtz explains that the vowel sounds differ from each other because of the predominance of certain frequency regions in the complex glottal tone, these regions being different and characteristic for each vowel...... Helmholtz states further that selective resonance of the vocal cavities acting on the complex glottal tone is responsible for the presence of these characteristic regions.

"Although the assumption that cavity air volume resonance is solely responsible for all vowel and voice quality differences is still generally held, certain investigations on the physiological side of the problem indicate that other influences may be at work. Numerous X-ray photographs made by Russell of subjects during normal speech show conclusively that different size cavities produce the same vowel and *vice versa*...... First, he suggests that variations of tension, density and similar influences in the cavity and aperture walls and variations in the structure of the cavities themselves may be of importance in modifying vowel and voice quality through a muffling or filtering effect. Thus the predominance of the low frequencies in the vowel *u* as in 'boot' may be due as much to the attenuation suffered by the high frequencies through this soft surface effect as to any cavity resonance acting on the low frequencies. His second suggested explanation is that the glottal tone quality itself may be varied in producing the various vowel or voice tone qualities. Motion pictures made by Russell of the glottal lips (vocal cords) during speech reveal a characteristic change of appearance of the interior larynx and glottal lips for different vowels, suggesting an altered glottal tone quality in such cases.......

"...... In most wind blown musical instruments the resonator controls the frequency of the vibrator. West assumes a corresponding influence of the vocal cavities over the vibration frequency of the glottal lips. Lamb.... states that the glottal lips act like reeds of small elasticity and are mainly controlled by the reaction of the resonant chamber. Helmholtz, on the other hand, states that because of their soft yielding walls, the vocal cavities are unable to affect the vocal cord tone, the cord frequency being controlled by variation of the cord tension. This latter view is supported by experiments conducted by Negus using an actual larynx coupled to a variable resonator.

37. JASA, Vol. 5, 1934, pp. 208-212.

" ...... Crandall remarks ...... that there are two effects of soft walls in a tube transmitting sound: first, the effective stiffness of the contained medium is diminished, causing a lowering of the wave velocity therein; second, because of dissipation in the wall and lateral radiation from it, the wave in the contained medium suffers increased attenuation .... Crandall's observations, however, apply when the stiffness of the wall and of the contained medium are comparable, whereas the walls with which we are concerned have a very small coefficient of elasticity.

" A few more questions requiring further experimental investigation concern transient oscillations in soft-walled cavities, the influence of the practically fixed subglottal or chest cavity on the laryngeal tone, the characteristics of complex coupled cavities such as are found in the vocal mechanism, etc.

(p. 211) " This resonator [' water resonator '] consisted of a layer of absorbent cotton sewed over an approximately spherical wire frame 14 cm. in diameter having an orifice 3 cm. in diameter. The wire frame weighed 17 grams, the dry cotton, 26·1 grams. When wet, the resonator weighed 345 grams., indicating the presence of 300 c.c. of water in the cotton. Scripture used a similar resonator in his attempts at artificial vowel production, but remarked that such a resonator ' responds equally well to all tones of a siren whether harmonic or inharmonic.'

(p. 212) " It is also of interest to note that a perceptible rise in the resonant frequencies for the softer-walled cavities is evident."

In his concluding remarks J. C. COTTON summarises[37a] the preliminary results of his investigations as follows:—

" (1) Soft walls greatly limit a resonator's ability to radiate energy from a given source.

" (2) The fundamental resonant frequency of a soft-walled cavity is higher than for a similar rigid-walled cavity.

" (3) Harmonics of the fundamental resonant frequency of a cylindrical soft-walled cavity do not follow in their normal odd harmonic order.

" (4) Plasticine forms a much more nearly rigid wall than flesh, and thus cannot be used for accurately representing a vocal resonator.

" (5) A ' water resonator ' has a distinct resonant frequency and does not respond equally well at all frequencies."

But contrast with these the following statement[38] made by A. T. JONES in his paper ' Organ Pipes and Vowel Quality '[39]:—

37a. *Ibid.*, p. 212.
38. My attention to this has been drawn by Mr. P. C. GANESHSUNDARAM.
39. JASA, Vol. 6, pp. 282-3.

"Russell describes an experiment as follows:—

'The author has a lead-tin, round-walled open organ pipe, pitched at a D$\#_4$ (615 d.v./sec.) which gives what is probably as passable an imitation of the vowel *a* (ah) as can be had by such mechanical means. If while this pipe is sounding, it is tightly grasped just above the exit (letting it fall in the soft crotch between the thumb and forefinger which are then pressed against it laterally) it speaks *au — au — au* as plainly as any other mechanical vowels the author has heard. At the same time its pitch is not lowered more than a fraction of a semi-tone...... The vowel quality change must therefore have been due to changed partials...... Since the *u* (oo) element sounds more muffled or dead, we must conclude without more physical evidence to the contrary that the *mere pinching of* the *pipe walls* at that point *by* the *soft fingers* served to deaden the higher partials; and that as a result of the suppression of those high partials, the vowel quality the pipe conveyed to our hearing was changed from *a* (ah) to *u* (oo). This change was without any doubt due to the effect of the wall surfaces, and could in no manner be attributed to any influence whatever of the air volume capacity of the cavity.'

"The Italics in this quotation are Russell's.

"...... If the pipe is blown steadily while the hand alternately leaves it free and then shades it there is a clear *au — au — au*. Moreover it is not necessary that the object which shades the pipe be soft — a piece of wood can produce the same effect."

6. *Production of Vowels*:—

We now proceed towards the further examination of the *Eḻuttatikāram* sūtras in this light.

Avvaḻip
Paṉṉīruyirun tannilai tiriyā
Miṭaṟṟup piṟanta vaḷiyi ṉicaikkum.

அவ்வழிப்
பன்னீ ருயிருந் தந்நிலை திரியா
மிடற்றுப் பிறந்த வளியி னிசைக்கும்.

"All the twelve vowels are produced by the air starting from the navel and passing through the neck without undergoing any modification."[40]

The modern science of physiology goes only so far to the lungs as origin of breath.

40. *Tol. Eḻut.*, sūtra 84.

Cf. also for the production of vocal sounds according to the old Indian conception of human physiology, *Saṅgītaratnākara* translated by Dr. C. Kunhan Raja, pp. 10-45, Ch. I, *Svara*. Origination of the Human Body. The Adyar Library Series, No. 51, Vol. 1, 1945, pp. 1-167. Adyar Library Edition.

7. *Definition of Speech Elements* :—

It is instructive to bear in mind here the modern definition of a vowel from practical phoneticians. JONES,[41] for instance, defines a vowel as being "a voiced sound in forming which the air issues in a continuous stream through the pharynx and mouth, there being no obstruction and no narrowing such as would cause audible friction."

As PIKE[42] points out, JONES gives his reasons for choosing such a delineation. "It so happens that the sounds defined as vowels in §97 are noticeably more sonorous than any other speech-sounds (when pronounced in a normal manner); and that is the reason why these sounds are considered to form one of the two fundamental classes."[43]

Further, I may point out here that the entire procedure in such an argument is erroneous. For, it is obvious that the very criterion JONES employs proves that the distinction between vowels and consonants is an arbitrary one. It is needless, therefore, to complicate still further the issue, as Jones does in a manner that is confusing, by saying that "The distinction between vowels and consonants is not an arbitrary physiological distinction."[44]

In the last analysis the distinction between these two fundamental entities in human speech must be examined from the view-point of methodological thinking of mathematics, out of physical and physiological investigations.

The result of such an examination reveals that the distinction is purely an arbitrary one, on which is based my *alpha-phoneme theory* and its further refinement or rather extension the *alpha-phonoid theory*.[45]

8. *Modern X-Ray Experiments Nullify Absolute Differentiation between Vowels and Consonants* :—

It is clear that the old conception caused a great divergency between vowels and consonants. MARICHELLE, HUISINGA and G. Oscar RUSSELL have

41. Daniel JONES, *An Outline of English Phonetics*, 6th Edn., Cambridge, England, 1947, p. 23.

42. K. L. PIKE, *Phonetics*, Ann. Arbor. University of Michigan Press, London, Oxford University Press, 1944, p. 69.

43. JONES, *ibid.*, §100, pp. 23-24.

44. *Ibid.*, p. 23.

45. C. R. SANKARAN, The Problem of the Structure of the Vowels and the Consonants in Human Speech, BDCRI, 9, pp. 184-193, 1948; The Alpha-Phonoid Theory, BDCRI, Vol. 10, pp. 61-67, 1950.

46. L. KAISER, Biological and Statistical Research Concerning the Speech of 216 Dutch Students, III. Timbre Phenomena in Speech, ANPE, Tome 17, 1941, p. 155.

Cf. also G. Oscar RUSSELL, *Speech and Voice*, 1931, p. 80.

pointed out the importance of the 'articulation place' of the vowels, as compared to the relative unimportance of the dimensions of the cavities. This conception brings together vowels and consonants, the difference being a gradual one.[46]

Above all, in the last analysis, when it comes to that, quoting L. BLOOMFIELD's words used in a different context, one can say that "we shall have to wait until physiology has reached a state of perfection that is at present inconceivable,"[47] to speak of "physiological distinction" in any serious sense of the term, in the context D. JONES speaks of it. A new type of physiological investigations, with the help of the recently devised Visible Speech apparatus of the Bell Telephone Laboratory scientists, is the hope of the author of this Monograph, to carry out with his collaborators not at a distant date.[48]

9. *The Phonemic Variants of Āytam:—*

With regard to my alpha-phoneme theory, the starting point of my investigations was the determination of the phonemic status of *Āytam* which has six different variants.[49] Each of these variants, being a term of an ordered class of minimum phonological differences among forms, is a *microphoneme.* The sum of all similarly ordered terms of similarly ordered classes is the abstraction called *macrophoneme;* the *entire Āytam* comprising the six different variants, therefore, constitutes one macrophoneme, and each of

47. L. BLOOMFIELD, Review of Wilhelm HAVERS's *Handbuch der Erklärenden Syntax. Language*, Vol. 10, p. 36, 1934.

48. Cf. "Movements as revealed by these visible patterns of speech should be of particular interest. No doubt what Paget calls the 'gestures of speech' are subject to the same limitations of inertia and continuity that tend to restrict speech and accuracy of movement in other parts of the body. It should be possible to study these restrictions by following the alterations of movement that accompany increase in speech rates. Possibly speech patterns synchronised with X-ray pictures would help materially to round out the present knowledge of speech production." R. K. POTTER, G. A., KOPP, and H. C. GREEN, *Visible Speech,* New York, D. Van Nostrand Co., Inc., 1947, p. 311.

The Phonetics Laboratory of the Deccan College Research Institute in my charge is reorganised now with the co-operation of my enthusiastic collaborators Messrs. A. U. MOMIN of the Radiation Laboratory, Meteorological Office, Poona, P. C. GANESHSUNDARAM (Scientific Assistant of the Phonetics Laboratory), and Mr. B. B. JOSHI, "Radionics" Poona, with the *minimum* electronic equipment such as the Cossor 1049 double beam and the Cintel universal oscilloscopes to work out physically the problem of speech-structure from the point of view of the alpha-phoneme theory, for which main purpose two specific special grants of Rs. 10,000/- each were generously given by Sir C. V. MEHTA of Bombay and the Bombay Government on the recommendation of Sir. C. V. RAMAN.

Here it may also be mentioned that in appreciation of his work on Indian music B. CHAITANYA DEVA was given a scholarship of Rs. 300 for the year 1949-50 by Swami KUVALAYANANDA, of Kaivalyadhama Samiti, Bombay.

49. C. R. SANKARAN and N. K. SRINIVASAN, The Phonemic Variants of Āytam in Old Tamil, BDCRI, Vol. 2, p. 348.

the six different variants being a fraction of that sub-abstraction is a set of microphonemes.[50]

10. *The Etymology of the Word Āytam and its Significance* :—

The word *Āytam* itself is derived from the Sanskrit *Āśritam* आश्रितम्. The correspondence symbolised by Sanskrit ś (श) Tamil *y* (ய்) is met with in many of the Indo-Aryan loan words in Tamil.[51] Sanskrit *Āśritam* while being borrowed into Tamil, loses *r*, *ś* is replaced by *y* and *i* by *u* (and then this *u* is dropped altogether).

Āśritam > Āyutam > Āytam
आश्रितम् > ஆயுதம் > ஆய்தம்.

The name *Āśritam* is significant, for this phoneme is modified by the following phoneme in the speech form in which it occurs, and accordingly becomes one or another of its six allophones (i.e. phonemic variants).[52]

Cārntuvari ṉallatu tamak kiyal pilaveṉat
Tērntu veḻippaṭutta vēṉai mūṉṟun
Tattañ cārpiṟ piṟappoṭu civaṇi
Yotta kāṭciyiṟ ṟammiyal piyalum.[53]

சார்ந்துவரி னல்லது தமக்கியல் பிலவெனத்
தேர்ந்து வெளிப்படுத்த வேனை மூன்றுந்
தத்தஞ் சார்பிற் பிறப்பொடு சிவணி
யொத்த காட்சியிற் றம்மியல் பியலும்.

11. *The Place of Occurrence of Āytam — its Production and its Status* :—

Āytam appears in the middle of a speech-form between a short vowel phoneme and one of a group of the six voiceless consonant phonemes which in turn is followed by a vowel phoneme.

Kuṟiyataṉ muṉṉa rāytap puḷḷi
Uyiroṭu puṇarntaval lāṟan micaittē.[54]

குறியதன் முன்ன ராய்தப் புள்ளி
உயிரொடு புணர்ந்தவல் லாறன் மிசைத்தே.

50. W. F. Twaddell, On Defining the Phoneme, *Language Monograph*, 16, 1935, p. 39.
51. Cf. Skt. *Śmaśāna* श्मशान > Tam. *Mayāṉam* மயானம்.
Śmaśru श्मश्रु > *Mayir* மயிர்.
M. R. Rajagopala Iyengar Phonetic Changes in Tamil Words Borrowed from Classical Sanskrit, *Journal of Oriental Research*, Madras, Vol. 14, 1940, p. 57.
52. C. R. Sankaran and N. K. Srinivasan, The Phonemic Variants of Āytam in Old Tamil, BDCRI, Vol. 2, 1941, p. 344.
53. *Tol., Eḻut.*, sūtra 101.
Cf. also P. S. Subrahmanya Śastri, *Tolkāppiyam Eḻuttatikāram*, with an elaborate commentary, 1937, p. 8.
54. *Tol. Eḻut.*, sūtra 38.

The group of six voiceless consonant phonemes referred to here are *k, c, ṭ, t, p* and *ṟ*.

Valleḻut teṉpa ka ca ṭa ta pa ṟa.[55]
வல்லெழுத் தென்ப க ச ட த ப ற.

"*K, c, ṭ, t, p* and *ṟ* are called *valleḻuttu* (voiced consonants)".

55. *Tol. Eḻut.*, sūtra 19; see also P. S. Subrahmanya Śastri, History of Grammatical Theories in Tamil, 1934, p. 43, footnote, 3.

Cf. too, C. R. Sankaran and G. S. Gai, JGJRI, Vol. 2, 1945, p. 171, footnote 19.

Tolkāppiyar enumerates *melleḻuttu* மெல்லெழுத்து (nasals) and *iṭaiyeḻuttu* இடையெழுத்து (semi-vowels?) in the following two sūtras:

Melleḻut teṉpa ṅa ña ṇa na ma ṉa.
மெல்லெழுத் தென்ப ங ஞ ண ந ம ன.
(*Tol. Eḻut.*, sūtra 20)

Iṭaiyeḻut teṉpa ya ra la va ḻa ḷa.
இடையெழுத் தென்ப ய ர ல வ ழ ள.
(*Tol. Eḻut.*, sūtra 21)

ḻ and ḷ are obviously not semi-vowels.

It was customary to credit the Tōḍa language with the voiced retroflex fricative ḻ found in Malayālam, Tamil, etc. (Cf. G. S. Gai, Historical Grammar of Old Kannada, *Deccan College Dissertation Series* No. 1, Poona, 1946, p. 16, footnote 39. L. V. Ramaswami Aiyar, Tamil ḻ, JORM, Vol. 9, pp. 140-5; cf. also "The Evolution of Old Malayālam" being the unpublished Ph.D. Thesis 1948 of another of my former students — Dr. A. C. Sekhar, sometime Visiting Lecturer in Dravidian Linguistics, Pennsylvania University, U.S.A.).

M. B. Emeneau now points out (*Language*, Vol. 23, 1947, p. 75, Review of G. S. Gai's Historical Grammar of Old Kannada) that "the missionary report on which the statement was originally based was not correct in its phonetic analysis and that the sound in question is really a voiceless retroflex lateral."

As he further says (*ibid.*), "The problem of the fate of ḻ in Badaga is also still to be examined by means of fresh observations in the Nilgiris."

It may be added here that M. B. Emeneau is fully justified in observing (*ibid.*) that his "short article on the vowels of this language (The Vowels of the Badaga Language, *Language* Vol. 15, 1939, pp. 43-7) is only a preliminary new examination, but makes it clear that the older statements about the language are not trustworthy."

Here is a vast rich field for an ambitious field-worker whose aim is to study in detail particularly the phonemics of the aborignal Dravidian dialects still extant (vide the presidential address of the Anthropology section, 37th Indian Science Congress, Poona, 1950.) in the wake of the methodology inaugurated by Pike and others.

Cf. K. L. Pike, *Phonemics*, University of Michigan Publications, Linguistics Vol. 3, 1947, Ann Arbor — University of Michigan Press; H. Hoijer and E. P. Dozier, The Phonemes of Tewa, Santa Clara Dialect, International Journal of American Linguistics, Vol. 15, pp. 139-144; Julia Supple and Celia M. Douglas, Tojolabal (Mayan): Phonemes and Verb Morphology, *Ibid.*, pp. 168-174; Henrietta Andrews, Phonemes and Morphophonemes of Temoayan Otomi, *ibid.*, pp. 213-22; Venda Riggs, Alternate Phonemic Analyses of Comanche, *ibid.*, pp. 229-231. Also, Bernard Bloch, A Set of Postulates for Phonemic Analysis, *Language*, Vol. 24, 1948, pp. 3-46; Rulon S. Wells, De Saussure's System of Linguistics, *Word*, Vol. 3, 1947, pp. 2-31, especially pp. 2-7; A. C. Sekhar and C. R. Sankaran; Notes on Colloquial Malayālam, BDCRI, Vol. 6, pp. 49-52; C. R. San-

L. V. Ramaswami AIYAR notes the significance of the syllable that immediately precedes the plosive and produces the *Āytam,* being usually short, and he suggests the possible influence of some kind of accent-distribution in the production of the aspirate[56] (as he takes the *Āytam* to be !)

Āyta nilaiyalum varainilai yin̲r̲ē
Takaram varūuṅ kālai yān̲a.[57]

ஆய்த நிலையலும் வரைநிலை யின்றே
தகரம் வரூஉங் காலை யான.

comprehends such sentences as :—

mul̲ + tītu > muஃṭītu (or muṭṭītu)
முள் + திது > முஃடீது (or முட்டீது).
Īr̲iyan maruṅkin̲u micaimai tōn̲r̲um.[57a]
ஈறியன் மருங்கினு மிசைமை தோன்றும்.

"ஃ appears in sandhi even when the final member of the preceding word combines with the initial member of the succeeding word."

E.g. Kal + tītu > kaஃr̲ītu.
கல் + தீது > கஃறீது.

We have also pattu பத்து side by side with paஃtu பஃது and attai அத்தை side by side with aஃtai அஃதை.[58]

KARAN and A. C. SEKHAR, The Dialects of the Extreme South of Kerala. BDCRI, Vol. 7, 1946, pp. 220-224 ; A. C. SEKHAR, A Note on the Dialect of Kayavar, BDCRI, Vol. 10, p. 47, 1950. Ernest BENDER and Zellig S. HARRIS, The Phonemes of North Carolina Cherokee, IJAL, Vol. 12, 1946, pp. 14-21 ; A. M. HALPERN, Yuma I ; Phonemics, *ibid.*, pp. 25-33 ; Herman P. ASCHMANN, Totonaco Phonemes, *ibid.*, pp. 34-43 ; Kenneth L. PIKE, Phonemic Pitch in Maya, *ibid.*, pp. 82-91 ; William L. WONDERLY, Phonemic Acculturation in Zogue, *ibid.*, pp. 92-95 ; Robert F. SPENCER, The Phonemes of Keresan, *ibid.*, pp. 229-236 ; Nadine WEATHERS, Tsotsil Phonemes with Special Reference to Allophones of B, *ibid.*, Vol. 13, 1947, pp. 108-111 ; Morris SWADESH, The Phonemic Structure of Proto-Zapotec, *ibid.*, pp. 220-230 ; Charles F. HOCKETT, Potawatomi I ; Phonemics, Morphophonemics and Morphological Survey, IJAL, Vol. 14, 1948, pp. 1-10 ; Paul L. GARVIN, Kutenai I : Phonemics, IJAL, Vol. 14, 1948, pp. 37-42 ; Henry OSBORN, Amahuaca Phonemes, *ibid.*, pp. 188-190 ; Hans WOLF, Yuchi Phonemes and Morphemes, with special reference to Person Markers, *Ibid.*, pp. 240-3. Viola WATERHOUSE and May MORRISON, Chontal Phonemes, IJAL, Vol. 16, 1950, pp. 35-39 ; Einar HAUGEN, Phoneme or Prosodeme ?, *Language*, Vol. 25, 1949, pp. 278-82 ; Charles C. FRIES and K. L. PIKE, Coexistent, Phonemic Systems, *Language*, 25, 1949, pp. 29-50 and K. L. PIKE, *Tone Languages*, Linguistics, IV, Ann Arbor, Michigan, 1948.

56. *The Indian Antiquary*, Vol. 59, 1930, p. 198, footnote 3.
57. *Tol. Eḻut.*, Sūtra 400.
57a. *Tol., Eḻut.*, Sūtra 39.
58. Cf. too,
Kal + tītu > Kaஃr̲ītu (or Kar̲r̲ītu)
கல் + தீது > கஃறீது (or கற்றீது).
Takaram Varumvaḻi yāyta nilaiyalum
Pukarin̲ ren̲man̲ār pulamai yōrē.

The *Āytam* was conceived to be neither a vowel nor a consonant.[59]

12. *The Alpha-Phoneme Theory :—*

Now it is certainly a matter of fundamental importance to be able to define precisely the positive qualities (let us call them V and C) which characterise the vowel and consonant phonemes. Linguistics has not been able to arrive at these.[60] Our normal expectation is that V and C must be mutually exclusive, i.e., no 'sound-profile' can have both the qualities V and C. The physical 'profile' is defined by the following equations :—[61]

$$y = f(t) = (1/\pi) \int_0^\infty d\omega \int_0^\infty dp \int_\alpha^\beta f(t') e^{-\omega p t'} \cos \omega (t' - t) dt'.$$

$$\omega = f_\omega (t') \text{ and } p = f_p (t').$$

A *physical* 'profile' P of a vowel of form (F) and duration (D) is expressed by :—

$$P = f(F) = f(i) = f\{\Sigma \alpha_i e^{-\delta_i x} \sin (\omega_i x + \theta_i)\}$$

where i implies the various elements that go to make up the *specific* character[62] of the vowel, $\propto$ the amplitude, δ the decrement, ω the frequency and θ the phase of the sinusoidal component.

A *physical 'profile'* may be conceived as of a four-dimensional character. Its projection on time alone we are concerned with here, and the above equations are purely of a qualitative character.

The *physical* 'profile' is not a sum of a few discrete free vibrations as they are supposed to be, but an integration of an infinite number of such vibrations differing infinitely little from one another.[63] A vowel is made up

தகரம் வரும்வழி யாய்த நிலையலும்
புகரின் றென்மனார் புலமை யோரே.

(*Tol.*, *Eḻut.*, Su. 370).

La ḷa vīṟ ṟiyaipiṉā māyta maஃkum.
ல ள வீற் றியைபினா மாய்த மஃகும்.
(Naṉṉūl, Su. 97, U. V. Swaminatha Iyer's Edition 2 1935 Madras, p. 55).
Cf. also, Pal + tuḻi > Paஃṟuḻi
பல் + துளி > பஃறுளி
(Puṟanāṉūṟu, 9. U. V. Swaminatha Iyer's Edn. 3, 1935, Madras, p. 30).

59. This tradition is kept up throughout. Cf. Vīramāmuṉivar, *Toṉṉūl Viḻakkam*, Urai 13, quoted by P. S. Subrahmanya Śastri, *Tamil Moḻinūl*, Trichy, 1936, p. 58.

60. C. R. Sankaran, On Defining the Alpha Phoneme, *Current Science*, Vol. 13, 1944, p. 11.

61. E. W. Scripture, *Nature*, 130, 1932, pp. 275-6.

——, The Nature of the Vowels, ANPE, Tome 7, 1932, pp. 64-70.

C. R. Sankaran and S. Sourirajan, A Physico-Physiological Theory of Syllables in Human Speech, BDCRI, Vol. 6, 1946, p. 236.

62. E. W. Scripture, The Nature of the Vowels, *The Physical Society Report of a Discussion on Audition*, held on June 19, 1931, at the Imperial College of Science, p. 45.

63. Cf. Alexander Wood, *Acoustics*, Blackie & Son, Ltd., London and Glasgow, 1943, p. 360.

of a series of adjacent vibration 'profiles',[64] the analysis of which shows that all the frequencies from 0 to ∞ are present to a greater or less degree. These infinitely small vibrations differing infinitely little from one another are taken by me to be 'profiles' in an extended sense in my alpha-phoneme theory, but the *physical* 'profile' is a vibratory-bit whose *pattern* repeats itself *periodically*.[65]

The 'shape' of the wave-form differs from one *physical* 'profile' to another. But the relations between the coefficients in the qualitative expressions given above remain constant. The parameters change from vowel to vowel, while the parametric equation remains constant. Since the shapes of the physical profiles differ from one another, we can at once think of speech-structure in terms of Bessel functions.[66] A. MAACK[67] in that manner studied the intonation patterns in German, and found that the rising inflexions of vowels and diphthongs tend toward *convex* forms, while consonants tend toward *concave* forms.[68]

64. SCRIPTURE, *Nature*, 1932, Vol. 130, p. 275.

65. SCRIPTURE, The Nature of Vowels, *Phys. Soc. Report on Audition*, pp. 44-52, (1931).

But he further says also that "the interval from the beginning of one bit to that of the next changes steadily throughout the vowel-stretch." (Cf. SCRIPTURE, Film-Tracks of English Vowels, JASA, Vol. 6, 1934, p. 170).

SCRIPTURE's equations indicate that the form of the equations is a constant for all vowels, but the parameters change from vowel to vowel. Also the form of vibration within the bits (physical profiles) changes gradually and progressively from one physical profile to another physical profile. (SCRIPTURE, Film Tracks of English Vowels, JASA, Vol. 6, p. 169).

If the vibratory-bits change from one to another for any particular vowel, then the coefficients in the equations for the physical profiles may be having a constant relationship (?) among themselves for all such physical profiles so that each physical profile taken separately characterises the particular vowel (?).

66. Cf. S. GOLDMAN, *Frequency Analysis, Modulation and Noise, Radio Communication Series*, New York-Toronto-London, Mc Graw-Hill Book Co., Inc., 1948, Appendix E, p. 417.

67. Formen des Melodieverlaufs Neu-Hochdeutsches Laute, *Archiv für Vergleichende Phonetik*, Vol. 3, 1939, pp. 27-37.

68. Cf. also *American Speech*, 14, 1939, p. 227.

We have seen that according to SCRIPTURE's equations the parameters change from vowel to vowel. Its meaning is that the physical profile of a vowel may differ in shape from the physical profile of another vowel, and therefore, it may be viewed as a Bessel function also which is very much like a damped sine or damped cosine wave except for the significant difference of having a different shape.

Now, this would mean only offering yet another explanation like SCRIPTURE's representative attempt at a ready-made solution of a vowel as a decremental sinusodal function when he found that the old classical Helmholtzian view failed to give adequately a correct picture of vowel-structure in particular, and for that matter, any speech-sound-structure in general.

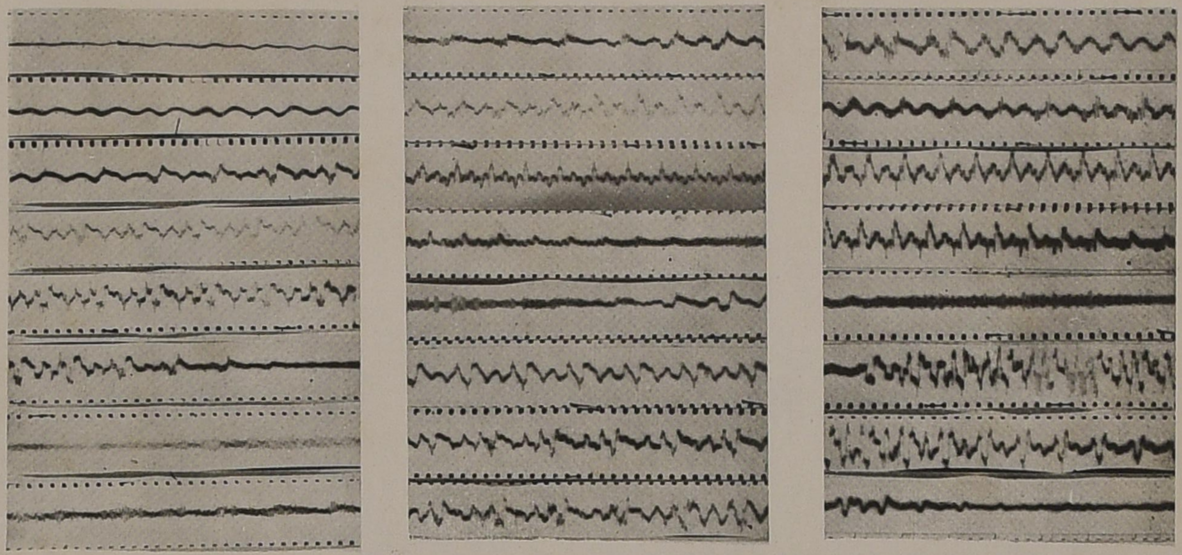


PLATE II

An Oscillogram of the Chinese Phrase "*Siao chung kno tzu yu szu sheng*" produced with the kind permission of Prof. A. Gemelli in illustration of his view, "that the language is a stream of sounds in which divisions can be placed only in the psychological period."

It is clear that the really essential physical considerations underlying the Alpha-phoneme theory are due to E. W. SCRIPTURE and A. GEMELLI.[69]

The alpha-phoneme theory originally started with the idea of establishing the phonemic status of the so-called *Āytam* in Old Tamil.[70] The *Āytam*-phenomenon of which the *Āytam* is a particular case, is now viewed as a generalised phenomenon in human speech, marking *physically* the *transient* stage between the consonant and the vowel, approximating to the mathematically constructed *conceptual limit* 'between' the consonant and the vowel in any consonant-vowel configuration with the theoretical acoustico-articulatory time-interval of *zero.* This conceptual 'cut' is non-linear, escaping time-process. Now the consonant and the vowel lose their *absolute* character. They are only *arbitrarily distinct.* A new way of defining in positive terms, mathematically speaking, of vowels and consonants in human speech, particularly in terms of differential (or partial differential) equations, as boundary conditions of the unobservable (indistinguishable) *conceptual limit,* is the perspective opened up by the alpha-phoneme theory.

13. *Epistemological Implications of the Alpha-Phoneme Theory :—*

The boundary conditions are the new knowledge, it is hoped, that we shall happen to possess about the vowels and the consonants in human speech, in the form of differential (or partial differential) equations; clearly the boundary conditions are not objective facts in the strictest sense of the term, as we shall presently see (cf. footnote 81). The supposedly fundamental law, viz., the alpha-phoneme construction with its logical implications, is wholly subjective. It is a pure concept — a mind-construct. Thus the region to be annexed to pure subjectivity is marked out under another name, viz., *fundamental.*

69. A. GEMELLI and PASTORI, L'Analisi Elettroacustica del linguaggio, Milan, 1934, GEMELLI-PASTORI, Analyse Eléctrique du Langage, ANPE, Vol. 10, pp. 1-29, GEMELLI-PASTORI, 'Nature of Vowels', *Revue d'Acoustique*, 2, pp. 169-88, may 1933, GEMELLI, Nouvelle Contribution à la Connaissance de la Structure des Voyelles, ANPE, 14, 1938, pp. 126-64, E. W. SCRIPTURE, *Nature,* 136, 1935,, pp. 455-6, E. W. SCRIPTURE, Observations on Filmed and Filtered Vowels, *Nature,* 130, 1932, pp. 275-6.

Prof. A. GEMELLI's oscillogram of the Chinese phrase "*Siao chung kno tzu yu szu sheng*" is produced here to illustrate his statement (made in a private communication to me dated 11th November 1948), "that the language is a stream of sounds in which divisions can be placed only in the psychological period".

See also footnote No. 83.

70. C. R. SANKARAN and N. K. SRINIVASAN, The Phonemic Variants of Āytam in Old Tamil BDCRI, Vol. 2, 1941, pp. 342-50.

"The part of our knowledge which is wholly subjective should be of a recognizably different type from that which involves the objective characteristics of the universe."[71]

The alpha-phoneme theory involves our procedure of observation and, therefore, is subjective. The objective definition of vowels and consonants is envisaged to be capable of being presented to us *via* our subjective forms of thought. Its origin is objective, even though we can only describe it in subjective terms of the alpha-phoneme theory.

14. *An Attempt at Harmonisation of Phonemics with Phonetics Through the Study of the Āytam-Phenomenon :—*

From the view-point of theoretical phonemics and theoretical phonetics, it is interesting that an attempt is now inaugurated towards 'harmonisation', if not 'unification' of both, through the alpha-phoneme theory. From this the step is easy for the reexamination of our intuitions of space and time through the new perspective opened by the alpha-phoneme theory. This is the border-line of mathematical physics and epistemology.

Any consonant-vowel configuration during actual utterance with the acoustico-articulatory time-interval *zero* 'between', is looked upon as a *continuum* of infinitely small vibrations differing infinitely little from one another,[72] which are taken as *durationless* ('space'-) instants.[73]

In our consonant-vowel configuration, we construct a continuum of point-instants as it were, in space-time as 'groups' of 'events',[74] since the sound-wave conceived as three-dimensional is *instant* by *instant* correlated with the three-dimensional articulatory complex (again *instant* by *instant*), as in Robb's theory.[75]

71. Eddington, *The Philosophy of Physical Science*, Cambridge, at the University Press, 1939, pp. 63-66, and especially 64.

72. These small vibrations are obviously the *bases* of E. W. Scripture's conception of physical 'profile'. For, according to him a 'profile' is an integration of an infinite number of vibrations differing infinitely little from one another. Cf. Alexander Wood, *Acoustics*, p. 360.

73. Cf. A. N. Whitehead, *An Enquiry Concerning the Principles of Natural Knowledge*, Cambridge University Press, 1925, pp. 2-8.

There is a philosophical difficulty here (see *ibid.*, p. 8):

"A 'continuity of existence' must mean an unbroken duration of existence. Accordingly it is admitted that the ultimate fact for observational knowledge is perception through duration; namely, that the content of a specious present and not that of a durationless instant, is an ultimate datum of science." (see also *ibid.* p. 24).

Cf. also in this connection H. Bergson, *Time and Free Will*, London, 1913, p. 82.

74. Bertrand Russell, *Human Knowledge—Its Scope and Limits*, George, Allen and Unwin Ltd., 1948, p. 12, and pp. 251-350.

75. A. A. Robb, *A Theory of Time and Space*, Cambridge, at the University Press, 1914, p. 4.

Here, obviously an 'element' of time is called an *instant* and is to be regarded as a fundamental concept. The system of geometry, which is envisaged to be built up in the wake of the alpha-phoneme theory in its present form, will therefore ultimately assume a sort of four-dimensional character, that is to say, any element of it is to be determined by four coordinates.[75a] The bases of the whole logical superstructure are the ideas of *before* and *after ;* I give them as ROBB has done the philosophical and physical meanings more or less on the self-same lines.[76] In a general way, it can be described that our continuum of *speech-elements* or 'profiles' (which are conceptualised abtractions) in any consonant-vowel configuration (with *zero* as the acoustico-articulatory[77] *interval* in *time* 'between'), *implies* that the time relations and space relations are to be regarded both as relations of one continuum here.[78]

Anyway, as we go *instant* by *instant* in our continuum, the philosophical problem still remains whether there is real continuity, or whether it ultimately reduces to only an aggregate of *discontinuous* 'elements'.

Also, even looking at the problem at the purely physiological level, when we consider the question of audition, the basilar membrane in the ear can respond to the sensations upto a particular minimum interval of time alone, beyond which it is *not* possible to detect the 'continuity' *between* the two sensations.[79] Very probably, that physically conceivable (i.e. *determinable*) interval, which corresponds to the actual *least* 'duration' between

75a. Cf. "The fact that the instantaneous geometry within a moment is three dimensional leads to the conclusion that the geometry for all event-practicles will be four-dimensional." A. N. Whitehead, *ibid.*, pp. 122-123.

76. Cf. A. A. Robb, *op. cit.*

77. Obviously the terms 'acoustical' and 'articulatory' themselves are denoting here conceptualised abstractions. For, at the acoustical (i.e. physical) and (articulatory) physiological (comprising muscular and auditory movements) levels the same terms have different connotations.

In the present context, the terms indicate a path to a subtler decree of abstraction due to the alpha-phoneme theory which can conveniently be described as a twilight zone, a penumbra of uncertainty into which we cannot penetrate through the physical, physiological and auditory levels of experimentation.

Cf. in this connection P. W. BRIDGMAN, *The Logic of Modern Physics,* Macmillan & Co., New York, 1938, pp. 33 ff. See also foot-note 99.

78. Cf. ROBB, *op. cit.*, pp. 8-9.

79. Cf. "Wegel and Lane have shown that pitch discrimination is so fine that it corresponds to a displacement of the resonance maximum along the basilary membrane of approximately 0·02 millimeters, or to a space sensibility about one hundred times greater than that of touch at the fingertips."

(Leonard T. TROLAND, Psycho-Physiological Considerations Relating to the Theory of Hearing, JASA, Vol. 1, 1930, p. 305).

I am indebted to my talented collaborator Mr. B. CHAITANYA DEVA, whose work on the bio-physics of Speech and Music is promising, for several illuminating discussions on this and allied topics.

the consonant and the vowel (in the consonant-vowel configuration under discussion), being *less* than this *minimum* 'interval', is not perceived, the sensitivity of the basilar membrane being dull at this *limit*, and therefore is assumed to be outside the time process (corresponding to the 'point-instant' definable in our continuum in the familiar manner of *Dedekind-postulate* when the interval is theoretically speaking *zero* in point of time 'between' the consonant and the vowel in the consonant-vowel configuration under discussion), and this is the physico-physiological *non-linearity* corresponding to the generalised *Āytam-phenomenon* in speech, i.e., paralleling to the non-linearity (purely conceptual, which is the *Dedekind-cut* in our continuum, based on the assumption of continuity, the ultimate speech elements being correlated with real numbers), in the geometrical theory concerning speech-structure due to the alpha-phoneme construction.

In our continuum, as in the kinematic relativity of MILNE[80] there is an infinity of 'particles' [or 'point-instants' or 'events', or 'event-particles' (in

Cf. too G. W. STEWART, Problems Suggested by an Uncertainty Principle in Acoustics, abstract:

"An uncertainty principle in acoustics, arising wholly from classical views, is presented. This principle is that $\Delta\nu.\ \Delta t \sim 1$, where ν is the intrinsic frequency of an acoustic signal and Δt is its time duration. Applying this principle one finds that it is consistent with experiments on the change in frequency in the vibrato and the failure to detect it by ear, with recorded tests on minimum perceptible differences in frequency, and with the minimal time for tone perception. The problems suggested by the principle are: (1) variations in Δt and $\Delta\nu$ by an artificial vibrato with aural observations of detectable $\Delta\nu$, (2) redetermination of minimum perceptible differences in frequency as dependent upon Δt and (3) an examination of Δt required for tone perception with varied values of $\Delta\nu$." (JASA, Vol. 2, 1930, pp. 325-29).

Cf. also, "Under certain circumstances the data and methods now represented by articulatory and acoustical phonetics may be compared for optimum efficiency in the discovery and description of facts about human speech. An approach to these circumstances may be made by proposing contrasts in procedural and interpretative limitation as they may hypothetically apply to the activities of scientists............(p. 245).

"......Acoustical phonetics and articulatory phonetics each provides a series of observables. But the heuristic linguist may judge between the two series, as to which most fully (~ subtly) discovers (~ illuminates) the facts of human speech production." (p. 246).

(W. D. PRESTON's Review of Raymond C. TRUEX and Carl E. KELLNER's *Detailed Atlas of the Head and Neck, Intern. Journal of Am. Ling.*, Vol. 15, pp. 244-46.)

Cf. for the relation of

$$\Delta t \cdot \Delta\nu \sim 1,$$

GABOR, Accountical Quanta and the Theory of Hearing, *Nature*, Vol. 159, 1947, p. 591; also *Nature*, Vol. 166, 1950, p. 725.

Also, N. WIENER, *Cybernetics*, John Wiley and Sons, New York, 1948, and Max BORN, Physics and Metaphysics, *Science News*, 17, 1950, p. 16 (Penguin Books).

80. E. A. MILNE, *Relativity, Gravitation and World-Structure*, Oxford, Clarendon Press, 1935, p. 9.

Cf. C. R. SANKARAN, The Problem of the Structure of the vowels and the Consonants in Human Speech, BDCRI 9, p. 189.

the sense of 'instantaneous point-events'),[81] as you will!], in the field of view of any observer merging towards the limit of visibility into a continuous background.

15. *The Arrangement of 'Profiles' in any CV-Configuration* :—

Now, there are three ways of looking at these 'profiles':[82]

1. We can conceive of a certain *number* of profiles to form any vowel or any consonant. Now, let us take a hypothetical case of a consonant-vowel (CV) configuration. Let C be made up of x profiles and V of y profiles separately. In the CV-conguration the total number of profiles may be expected to be either $x + y$ or *less*. If *less*, then how are we sure that some of the x 'profiles' which originally formed separately the C have not gone, and freely mixed up with y 'profiles' which originally formed the V, and *vice versa*. These questions deal with the pure logical 'fictions', leaving physics far behind, although that serves as a strong foot-hold for the logical structure.

Taking now the other sub-alternative, i.e., if $x + y$ is the number of 'profiles' in the CV-configuration, then also the objection raised above holds good, unless we choose to say that x is a separate 'packet', and y another similar separate 'packet', which of course *implies* that the C-class has a maximum and the V-class has a minimum. But this is not true; all the experimental evidence negatives such a supposition. It is clear that there are no ascertainable change-points. All the laboratory investigations lead to the conclusion that there are no definite change-points.[83] Experimental evidence also contradicts the existence of the hypotheticated separate 'packet' of even the *physical* 'profile'.[84] For, E. W. SCRIPTURE's contention is that in his experiments of filtering out various regions of frequency in the following manner (1) all frequencies above 1350 cycles/sec., (2) all frequencies below 750 c/s, (3) all frequencies above 1350 and below 750 c/s, (4) all frequencies between 750 and 1350 c/s, the musical character of the speech alone

81. A. N. WHITEHEAD, *The Principles of Natural Knowledge,* Part I, p. 33 and Part III, pp. 101-64, especially pp. 121-3. Cf. "An event-particle is the route of approximation to an atomic event, which is an ideal satisfied by no actual event," *ibid.*, p. 121.

Cf. also Felix KAUFMANN, Cassirer's Theory of Scientific Knowledge, *The Philosophy of Ernst Cassirer*. The Library of Living Philosophers, Vol. VI, 1949, p. 198, and,

Bertrand RUSSELL, for the concept of events, *History of Western Philosophy,* London, George Allen and Unwin, Ltd., 1946, pp. 860-1; A. EINSTEIN, *Out of my Later Years,* Thames and Hudson, London, 1950, Pages 78 and 80, 93 and 95.

82. It is obvious that the term is used *not* in SCRIPTURE's sense, but in our extended sense.

83. Cf. C. R. SANKARAN, On Defining the Alpha-Phoneme, *Current Science,* 13, 1944, p. 12. Cf. footnote 69.

84. In SCRIPTURE's sense.

changed with every alteration but the specific character of the vowels remained unchanged.[85]

2. The second alternative of looking at our 'profiles'[86] is that they are qualitatively different, one from another. Now, even the bare surface difficulty in adopting this view, is quite obvious. For, even at the very first sight, it appears tautological to say that any 'consonant-profile' is qualitatively different from any other 'consonant-profile' (or any 'vowel-profile'), and similarly any 'vowel-profile' is qualitatively different from any other 'vowel-profile' (or any 'consonant-profile').

3. Now we are left only with the third alternative, viz., *arrangement.* Thus the infinitely small 'profiles' incapable of being still further analysed each into its components, forming the consonant, follow one another conceivably arranged, and similarly do also the 'profiles' of the vowel, in the consonant-vowel configuration under discussion, the *entire set* of such an infinite series of 'profiles' constitutes a *continuum* with a *Dedekind-cut* (viz., the interval between the two section-points).

Obviously, while the 'vibratory-bit' is the physical 'profile' of SCRIPTURE, in the alpha-phoneme theory, the term 'profile' stands for every one of the vibrations differing infinitely little from one another, which is *before* or *after.* In other words, the theory of infinite aggregates or sets is involved in the new approach inaugurated now towards the question of speech-structure, due to the alpha-phoneme theory. For, in our continuum the relation of magnitudes between the successive elements is disregarded and the sequence here consists of 'elemental profiles', involving only *arrangement.* The filtering of certain regions of frequencies has been already referred to above as not affecting the specific character of any vowel.[87]

Thus, as we have seen, the 'profile theory' of E. W. SCRIPTURE as well as the electro-acoustical investigations of A. GEMELLI, serve as the physical basis of the new geometrical theory due to the construction of the alpha-phoneme in a continuum of 'elemental profiles' in any consonant-vowel configuration during the actual utterance where the acoustico-articulatory interval between the consonant and the vowel is *zero* in point of time, theoretically speaking.

SCRIPTURE's profile theory is extended here to define the infinite number of vibrations, differing infinitely little from one another and each subject to

85. Alexander WOOD, *Acoustics*, 1940, London and Glasgow, p. 360.
86. Of course, in our extended sense.
87. E. W. SCRIPTURE, *Nature,* Vol. 130, pp. 275, 965 (1932).
Obviously we may conceive this to be true of any consonant as well, both the vowel and the consonant being mutually exclusive only on physico-phonetic grounds supported by the experimental evidence of TANAKADATE. Cf. Prof. A. TANAKADATE. A Study of Japanese Phonemes by Means of Tone Films, *Proc. of the II Interna. Congr. of Phonetic Sciences,* Cambr. at the Univ. Press, 1936, pp. 117-122.

specific damping, as 'elemental profiles' forming a continuum in our consonant-vowel configuration. These 'elemental profiles' are again in their turn correlated with articulation which is a three dimensional complex. Such correlated 'elemental profiles' are spoken of as 'events' in our continuum. In the manner of Dedekind's postulate, a *cut* is constructed in this *continuum*, and the geometrical part of the new theory, therefore, naturally deals with mathematical consequences and the logical foundations of this concept. The physical extension covering the derivative consequences, and the more direct physical verification of the theory are at present envisaged. The derivative consequences are the observational predictions.[88] The more direct physical verification refers to setting up sets of differential equations for different 'environments' (which in turn are referred to a 'standard' or 'unit' *environment*),[89] the vowels and the consonants being then derived as boundary conditions. Obviously, the physically determinable interval (namely, experimentally approachable interval) most precisely approximating to the theoretical zero in point of time in our consonant-vowel configuration, is involved in the definition of these environments. As it stands at present, the alpha-phoneme theory concerns itself with a three-dimensional continuum of speech elements (frequency, time and amplitude) involving Topological and Riemannian concepts.[89a]

16. *The Change of Perspective due to the Alpha-Phoneme Theory*:—

Now, let us take any consonant-vowel configuration with the acoustico-articulatory interval between the consonant and the vowel approaching the theoretical absolute zero in point of time. Merely fitting up differential equations of various orders in the transient analysis 'between' the consonant and the vowel in any such consonant-vowel configuration and through such differential equations attempting to redefine the consonants and the vowels

88. See for instance C. R. SANKARAN and S. SOURIRAJAN, A Physico-Physiological Theory of Syllables in Human Speech, BDCRI, Vol. 6, 1946, p. 242.

C. R. SANKARAN, The Problem of the Structure of the Vowels and the Consonants in Human Speech, BDCRI, 9, 1948, pp. 192-3.

89. Cf. C. R. SANKARAN, *ibid.*, p. 191.

Also C. R. SANKARAN, *the Alpha-Phonoid Theory (A Study of Speech Structure)*, BDCRI, Vol. 10, pp. 61-67.

For the concept of 'environment' as applied to music see C. R. SANKARAN and B. CHAITANYA DEVA, *Postulational Methods and Indian Musicology, Journal of the University of Bombay*, September 1949, Vol. 18, Arts Number, Part 2, No. 24, pp. 78 ff. See especially footnote 18 on p. 78.

B. CHAITANYA DEVA, The Psychology of the Drone in Melodic Music, BDCRI, Vol. 10, pp. 69-84. (For abstract of this paper see *Proceedings of the 37th Indian Science Congress*, Poona 1950, Part III, Abstracts, p. 100). Cf. further footnote 95.

89a. For a general introduction to Topological ideas, see Maurice FRECHET and Ky FAN, *Introduction à la Topologie Combinatoire*, I Initiation, Paris Librairie Vuibert, Boulevard Saint-Germain, 63, 1946.

in human speech would only be tantamount to other translations[90] of the language of mathematical technique, and have not necessarily much to do with the phenomenon of the ultimate structure of speech-elements. Such a translation leads fundamentally to no new facts about the speech-phenomena; it merely gives an alternative description of the phenomena, i.e., a new description of the same phenomena from the old point of view. We only get a new fact about the phenomena where we change the point of view which is now provided by the background of all the logical implications of *Dedekind-cut* axiom which is at the basis of the alpha-phoneme theory. It must not be forgotten that the electro-acoustical investigations of A. Gemelli serve only as the physical basis of a new geometrical theory concerning speech-structure. It must be remembered, on the other hand, that A. GEMELLI seeks in his investigations a confirmation of his already pre-formed[91] conclusion that phoneme has *no* physical reality.

A densely ordered set of 'elemental profiles' *correlated* with articulation form a three-dimensional acoustico-articulatory events in the continuum of our study. The conceptual alpha-region[92] is *non-linear* escaping time, being surrounded by *time-space* on either side, our continuum being conceivably a *spatial* one. The 'elemental profiles' are *assumed* to be *same* in any speech-sound. The alpha-phoneme is thus a strong pointer towards a positive definition of vowels and consonants in human speech.

17. *Physical Translation of the Alpha-Phoneme Theory — The Alpha-Phonoid :—*

A more direct physical translation of the conception means finding that small interval experimentally approachable to the absolute theoretical zero 'between' the consonant and the vowel in our configuration. The structure within that interval in a certain standard situation which is called *Āytam-phenomenon,*[93] may be defined as a characteristic value differential equation.[93a]

90. Like SCRIPTURE's, for instance, which is a more divergent mode of ordering the facts of our experiences concerning speech elements, than the one adopted in this Monograph. In *our* ordering, on the other hand, these physical experiences become a continuous series of 'point-events' indeterminate in number. The linear series taken together, stand as coordinates in a continuum of three dimensions.

91. May we say *pre-judged?*

See for instance, A. GEMELLI, Observations sur le Phonème au Point de Vue de la Phychologie, *Acta Psychologica,* 4, No. 1, pp. 83-112, La Haye — Martinus Nijhoff — 1938.

92. Viz., the *Dedekind-cut.*

93. After the *Āytam* in Old Tamil, which is clearly a marginal *non-linear* (?) phoneme.

This so-called Āytam has its correspondent in all human languages. The *Āytam* and its correspondents are only particular cases of the *Āytam Phenomenon.*

93a. *Cf.* in this connection SHRÖDINGER's Wave equation

$$\left(\frac{d^2}{dx^2}+\frac{d^2}{dy^2}+\frac{d^2}{dz^2}\right)\psi+\frac{4\pi\, im}{h}\cdot\frac{d\psi}{dt}-\frac{8\pi^2 m}{h^2}\;V\;\psi=0;$$

Sir James JEANS, *The New Background of Science,* Cambridge University Press, 1947, Ch. 6, pp. 198-234, especially p. 208.

This is a 'standard' (or 'unit') *environment* in speech known as the *alpha-phonoid.*[94] In this way, setting up a 'standard' or 'unit' *environment* in speech, in terms of which all other *environments* both in speech and music[95] can be defined, is parallel to the situation obtained in MILNE's *Kinematic Relativity,* where the leading idea is not that of transformation of *coordinates* but of transformation from *observer* to 'equivalent' *observer.*[96]

The alpha-phoneme theory is, therefore, a geometrical physical theory which is tantamount to the logical analysis of our intuitions of space and time once again from the view-point of our freshly opened studies of speech-structure.

Points as simple entities disappear in modern scientific thought, for space is conceived as nothing but relations between material bodies.[97] Now, what is known as a 'consentient' set is defined as follows :—

"Thus each rigid body defines its own space with its own points, its own lines, and its own surfaces. Two bodies may agree in their spaces; namely, what is a point for either may be a point for both. Also if a third body agrees with either, it will agree with both. The complete set of bodies actual or hypothetical, which agree in their space-formation will be called a 'consentient' set."[98]

The assumption of one absolute time is contradicted by the Lorentzian formulae for transformations. Let an event-particle P happens at the point P_α in the α-space and at the point P_β in the β-space and let another event-particle Q happen at points Q_α and Q_β in the two spaces respectively. Contrary to the traditional outlook which does not discriminate P_α from P_β and similarly Q_α from Q_β and therefore assumes that the distance $P_\alpha Q_\alpha$ is equal to $P_\beta Q_\beta$ because on the traditional theory they are symbols for the same distance, according to the Lorentzian formulae, such corresponding distances in the two spaces will not in general be equal. Keeping in mind the true distinction between the α-space and the β-space including the fact that the points in the two spaces are radically distinct, the equality of the distances $P_\alpha Q_\alpha$ and $P_\beta Q_\beta$ is not so obvious as the traditional outlook makes it out to be.

94. Cf. C. R. SANKARAN, BDCRI, 9, p. 192.

95. Particularly in the highly complicated melodic structures of our Indian music. Cf. also footnote 89.

See C. S. AYYAR, A Study of the Microtonal Variations in Frequencies in Karnatic Music, *Current Science,* Vol. 18, 1949, pp. 272-4; J. Murray BARBOUR, Musical Scales and their Classification, JASA, Vol. 21, 1949, pp. 587-589.

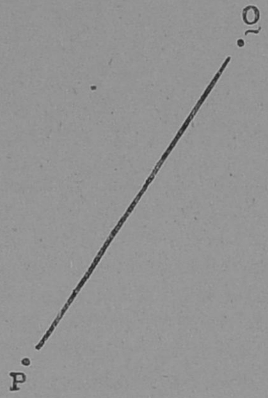
The concept of *existentiality* of 'Perceptual' organisation in melodic music is discussed by B. CHAITANYA DEVA in his "The Psychology of the Drone in Melodic Music."

96. E. A. MILNE, *Relativity, Gravitation and World-Structure,* Oxford, Clarendon Press, 1935, p. 5.

97. A. N. WHITEHEAD, *The Principles of Natural Knowledge,* Cambr. at the Univ. Press, 1925, p. 31.

98. *Ibid.*

Again, "if the two event-particles P and Q happen simultaneously when referred to the points P_α and Q_α in the α-space they will in general not happen simultaneously when referred to the points P_β and Q_β in the β-space.



This result of the Lorentzian formulae makes the time-system depend on the consentient set which is adopted as the standard of reference. Thus there is an α-time as well as an α-space, and a β-time as well as a β-space."[99]

99. *Ibid.*, pp. 44-5.

Our CV-Configuration is a continuum of acoustico-articulatory events which, as we have already seen, can be viewed as *durationless* 'space-instants'.

The acoustical-time (*spatialised*) is the α-space. The articulatory-time (likewise *spatialised*) is the β-space.

There is *correlation* between the two *spaces,* but they are *not* identical; they are *distinct,* one from the other.

The points in the two spaces are also radically distinct.

Even from the view-point that the *time-system* depends on the consentient set, the *unspatialised* articulatory-time (the β-time) which corresponds to the *spatialised* articulatory-time (the β-space) is different from the *unspatialised* acoustical-time (the α-time) which corresponds to the *spatialised* acoustical-time (the α-space). [Cf. A. N. Whitehead, *ibid.*, p. 149].

The acoustical-time is obviously the *physical-time,* and the articulatory-time is the *physiological time.* (Cf. also footnote 77).

For a general and a wider discussion with several implications on the question of *physiological time* being different from the *physical time,* see Alexis CARRELL, *Man the Unknown,* Pelican Books, 1948, pp. 152-179.

Cf. also for the brilliant attempt at establishment of a definite relation between an individual *physiological* time and the *physical* time, the outstanding work of Lecomte du NOÜY's *Biological Time,* 1936, Methuen and Co., Ltd., London, especially part 3, pp. 125-77.

In our CV-Configuration, both C and V can also be viewed as two material bodies in motion which is considered as due to the mutual interaction of the two bodies in question and which can be discussed by the aid of mathematical analysis. (E. T. WHITTAKER, *A Treatise on the Analytical Dynamics of Particles and Rigid Bodies with an Introduction to the Problem of Three Bodies,* 4th edition, New York, 1944, p. 1).

Now on such a reasoning, as against all the traditional outlook,[100] the articulatory-time is, therefore, bound to be different from the acoustical-time, and not equal to it.

The theory of the alpha-phoneme which deals with a continuum of acoustico-articulatory 'events' in any consonant-vowel configuration with the theoretical acoustico-articulatory time interval of zero between the consonant and the vowel during actual utterance, touches this problem at a far deeper level than it had been imagined, dealing with the interesting question of the possibility of the articulatory-time differing from the acoustical-time. In fact, such a problem has never been posed at all so far as I know. This is a distinct contribution, therefore, to epistemology from the view-point of the alpha-phoneme theory.

There arises at this point yet another fascinating problem too. According to CANTOR, the infinity of geometrical points is larger, or stronger than the inifinity of all integers or fractional numbers.[101] Now, there are two alternative ways of looking at *time* with which our continuum of 'point-singularities' is *congruent*. If it were considered as a continuum of integers being

100. De Saussure, *Cours de Linguistique Générale,* 2nd Ed., 1922, pp. 65 ff.

"La délimitation des sons de la chaîne parlée ne peut donc reposer que sur l'impression acoustique ; mais pour leur description, il en va autrement. Elle ne saurait être faite que sur la base de l'acte articulatoire, car les unités acoustiques prises dans leur propre chaîne sont inanalysables. Il faut recourir à la chaîne des mouvements de phonation ; on remarque alors qu'au même son correspond le même acte : *b* (temps acoustique) = *b*' (temps articulatoire). Les premières unités qu'on obtient en découpant la chaîne parlée seront composées de *b* et *b*' ; on les appelle *phonèmes ;* le phonème et la somme des impressions acoustiques et des mouvements articulatoires, de l'unité entendue et de l'unité parlée, l'une conditionnant l'autre : ainsi c'est déjà une unité complexe, qui a un pied dans chaque chaîne,"

(Cf. also Rulon S. WELLS, De Saussure's System of Linguistics, *Word,* Vol. 3, 1947, p. 2.)

For the convenience of a certain class of readers of this Monograph who may not be able to follow the original French of de SAUSSURE, I give below a free rendering of the above passage, for which I am particularly indebted to Sri P. C. GANESHSUNDARAM :

"The delimitation of the sounds of a speech sequence (chaîne parlée) can thus be based only on the acoustical impression ; but, as far as the description of sounds is concerned, it is different. It is recognised to be built only on the basis of the articulatory act ; because the acoustic units taken in their proper succession are unanalysable. One must take recourse to the succession of the movements of phonation ; it is then observed that to the same sound corresponds the same act : *b* (acoustic time) = *b*' articulatory time).

The primary units which are obtained on dividing the speech sequence will be composed of *b* and *b*' ; they are called *Phonemes ;* the phoneme is the sum of the acoustic impressions and the articulatory movements, the heard unit and the spoken unit, the one conditioning the other : thus it is already a complex unit, having a hold in each speech sequence."

101. George GAMOW, *One Two Three — Infinity — Facts and Speculations of Science,* London, Macmillan and Co., Ltd., 1946, p. 20.

conceivably a denumerable set of ultimately discontinuous infinitely small 'instants', there is no difficulty in conceiving that our continuum of 'point-singularities' has a *stronger infinity* with its 'cut' constructed in the manner of Dedekind postulate, than the infinity of time-instants having one-one correspondence with all the integers or fractional numbers. In other words, as according to CANTOR, our continuum of 'point-singularities' has a greater cardinal number than the supposed time-continuum has.[102] It is only on this explicit assumption that the epistemological implication that the 'cut' in our continuum of 'point-singularities' has *no* corresponding element in the time-continuum, is derivable from the alpha-phoneme theory. If, on the other hand, the *time-system* is considered as a 'linear continuum' then the infinity of our continuum of 'point-singularities' has the *same* strength as the infinity of the time-continuum.[102a]

It is interesting to reflect here that hitherto our continuum of 'point-singularities' is conceived to have been divided by the Dedekindian 'cut'

102. Cf. R. COURANT and H. ROBBINS, *What is Mathematics?* Oxford Univ. Press, London — New York — Toronto, 1946, pp. 83-6.

102a. Cf. in this connection, A. N. WHITEHEAD, *The Principles of Natural Knowledge,* p. 115.

Cf. also the following:

"A pertinent question for contemporary metaphysics is whether the logical theory of a time-series constructed on the analogy of a one-dimensional number continuum is competent to deal with the more elusive, and possibly more essential, aspects of our experience of time", C. T. K. CHARI, On Representations of Time as "The Fourth Dimension" And Their Metaphysical Inadequacy, *Mind,* A Quarterly Review of Psychology and Philosophy, Vol. LVIII, N. S., No. 230, 1949, p. 220.

For the metaphysical view of time, see Mary STURT's *The Psychology of Time,* Kegan Paul, London, 1925, pp. 1-11.

In this connection, I quote too here the following pertinent remarks of Sri. C. T. K. CHARI, (Department of Philosophy and Psychology, Madras Christian College, Tambaram, S. India) in a private communication to me dated 14th March 1950, while discussing the term 'dimensionality' used by psychologists and philosophers in a very vague sense:

"Dimensionality is strictly speaking a topological not a metrical concept. CANTOR's 1 : 1 correspondence between the points of a line and the points on a plane and PEANO's 'space-filling curve' (continuous mapping of an interval on a square) explode the usual ideas".

[Cf. R. VAIDYANATHASWAMY, *Treatise on Set Topology,* Part I, Madras, 1947, p. 121; HOBSON's *Functions of a Real Variable,* Vol. I, pp. 452-455.

It may be noted here that Peano's demonstration of the existence of a 'curve' that fills a whole square is "in the sense of intuitive interpretation a highly paradoxical creation"; (E. CASSIRER, *The Problem of Knowledge,* 1950, p. 24, Oxford University Press, London).]

102a (i). For theory of sections and the closure function see R. VAIDYANATHASWAMY, *Treatise on Set Topology,* Part I, Madras 1947, §10, p. 37, and Ch. IV, pp. 53ff, respectively; Cf. too Solomon LEFSCHETZ, *Introduction to Topology,* Princeton, New Jersey, 1949, Princeton University Press, p. 27 and p. 162: L. PONTRJAGIN, *Topological Groups,* translated from the Russian by Emma LEHMER, Princeton Univ. Press, London: Humphrey Milford, Oxford Univ. Press, 1946, p. 220.

into two simply connected regions, viz., the consonant and the vowel. This is in the wake of concepts of Topological transformations having the invariant property of 'closure' and recognising only two categories 'open' and 'closed' *sets.*[102a(i)] But it is also possible to consider our problem as one of 'discontinuous' transformations (as, for instance, when we adopt the view that the time-continuum on which are superposed the aggregates of our 'point-singularities' is a continuum of integers), where the property of existence and non-existence alone matter, all categories merging into one. We are thus deviously led once again to the threshold of the philosophical enquiry concerning the ultimate 'discontinuity' or 'continuity' in Nature.[103]

So far, however, it has been found convenient to regard our continuum of 'point-singularities' as non-denumerable set since it appears possible to establish correlation with the non-denumerable set of real numbers.[104]

18. *Tolkāppiyar's Discussion on the Non-linear Phonemes ī ŭ and The Āytam* :—

The three non-linear phonemes *ī*, *ŭ* and ஃ depend upon the *sufficient condition* of the adjacent consonant for their occurrence.

(a) *Discussion of Kuṟṟiyalikaram and Kuṟṟiyalukaram in Eḻuttatikāram* :—

While in the case of the *Āytam*, as we have just seen, it is the one that succeeds, in the case of ī and ŭ such an *adjacent consonant* is the one that *precedes*. Tolkāppiyar classified the *non-linear phonemes* ī and ŭ found respectively in the speech-forms kēṇm$^{\bar{\imath}}$ya கேண்மியா nāk$^{\bar{\imath}}$yātu நாகியாது and n$^{\breve{u}}$ntai நுந்தை under *Kuṟṟiyalikaram* and *Kuṟṟriyalukaram.*

Kuṟṟiya likara niṟṟal vēṇṭum
Yāveṉ ciṉaimicai yuraiyacaik kiḻavik
Kāvayiṉ varūu makara mūrntē.[104a]

குற்றிய லிகர நிற்றல் வேண்டும்
யாவென் சினைமிசை யுரையசைக் கிளவிக்
காவயின் வரூஉ மகர மூர்ந்தே.

"ī stands after *m* and before *ya* in the *iṭaiccol* '*mīyā*' (மியா) used with a verb when a person is addressed."

103. Cf. A Note on the Epistemological Implications of the Alpha Phonoaid Theory.
Cf. in this connection, Louis De BROGLIE, Continu et Discontinu en Physique Moderne, Sciences D'Aujourd'hui Collection Dirigée par André George, Edition Albin Michel, Paris, 1941.
In this connection, it is very refreshing to find Daniel JONES pointing out that the Phoneme Theory has a bearing upon questions relating to "existence" or "non-existence" (Cf. Daniel JONES, *The Phoneme — Its Nature and Use*, Heffer — Cambridge, 1950, pp. vii and 217).

104. Cf. Richard COURANT and H. ROBBINS, *Op. cit.*, p. 81.

104a. *Tol., Eḻut.*, 34.

E.g.:

Kēṇmⁱyā கேண்மியா
Ceṉmⁱyā சென்மியா.

Puṇariya ṉilaiyiṭaik kuṟukalu murittē
Uṇarak kūṟiṉ muṉṉart toṉṟum.[104b]

புணரிய னிலையிடைக் குறுகலு மூரித்தே
உணரக் கூறின் முன்னர்த் தோன்றும்.

"ĭ may also stand as the final member of the first two words in sandhi."

E.g.:

Nakŭ + Yatŭ > Nakⁱyātŭ
நாகு + யாது > நாகியாது.

Kuṟṟiya lukara muṟaippeyar maruṅkiṉ
Oṟṟiya nakaramicai nakaramoṭu mutalum.[104c]

குற்றிய லுகர முறைப்பெயர் மருங்கின்
ஒற்றிய நகரமிசை நகரமொடு முதலும்.

"ŭ follows the initial n of personal pronouns followed by words denoting relationship."

E.g.:

Num + tantai > nŭntai
நும் + தந்தை > நுந்தை.

It is exciting to find out that the speech-form nŭntai நுந்தை [actually spoken !] exhibited sometimes the non-linear phoneme ŭ while at other times the linear phoneme u in the same sense of 'your father' (num + tantai நும் + தந்தை) during Tolkāppiyar's time ![104c (i)]

104b. *Tol., Eḻut.,* sūtra 35.

104c. *Tol., Eḻut.,* sūtra 67.

104c (i) The forms *nŭntai* and *nuntai* can be analogically compared respectively to the two tell-tale South Indian Rāgas *Devagāndhāri* and *Ārabhi* which have the *same* notes, omitting of course the additional B_b in *Devagāndhāri*.

Among these two Rāgas, only in the former the combination of the notes tends to the conceptual non-linearity in actual singing, this characteristic alone marking *Dēvagāndhāri distinct* from *Ārabhi*.

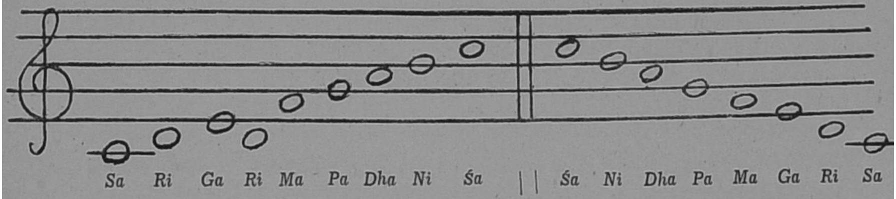
In the 'Psychological Gestalt' (I owe this happy suggestion to B. Chaitanya Deva) even the notes of *Dēvagāndhāri* and *Ārabhi* are *not* exactly alike, though one Rāga when sung, may analogically suggest the other Rāga. (This reminds us once again of "the basic concessive assumption of science: No two things and no two events are exactly alike". Cf. W. F. Twaddell, On Defining the Phoneme, p. 37).

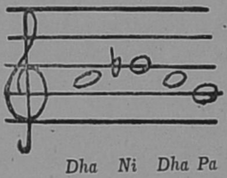
Tolkāppiyam Eḻuttatikāram sūtra 67 as well as sūtras 61 and 68 respectively given here reveal Tolkāppiyar's keen perception of both the non-linearity and linearity in the matter of phoneme-combinations in the stream of speech.

Kaṭana pamaveṉu māvain teḻuttum
Ellā vuyiroṭuñ cellumār mutalē.[104d]

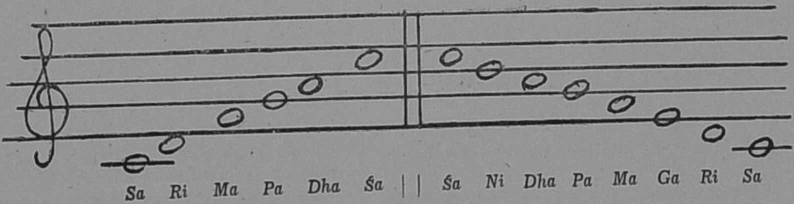
கதந பமவெனு மாவைந் தெழுத்தும்
எல்லா வுயிரொடுஞ் செல்லுமார் முதலே.

The scales of the two Rāgas are given below:
The scale of Dēvagāndhāri:





is an additional and special characteristic phrase of the *Rāga*.
The scale of Arabhi:



104d. Tol., Eḻut., sūtra 61.

"*K, t, n, p* and *m* can be followed by *any* vowel when they stand initially."

The structural difference of Tamil marking it distinct from Sanskritic structure in the matter of having *no* initial conjunct consonant in the former is noted in the sūtra.

Muṟṟiya lukaramoṭu poruḻvēṟu paṭāa
Tappeyar maruṅki ṉilaiyiya lāṉa.[104e]

முற்றிய லுகரமொடு பொருள்வேறு படாஅ
தப்பெயர் மருங்கி னிலையிய லான.

"*u* in words like *nuntai* [side by side with *nŭntai*] serves the same purpose as *ŭ* without altering the meaning."

Neṭṭeḻut timparun toṭarmoḻi yīṟṟuṅ
Kuṟṟiya lukaram vallā ṟūrntē.[104f]

நெட்டெழுத் திம்பருந் தொடர்மொழி யீற்றுங்
குற்றிய லுகரம் வல்லா றூர்ந்தே.

"ŭ appears as the final member after a hard consonant in words having a long vowel before it or in *toṭarmoḻi*,"

E.g.:
Nākŭ நாகு
Teṅkŭ தெங்கு
Varakŭ வரகு
Teḻkŭ தெள்கு

Iṭaippaṭiṟ kuṟuku miṭaṉumā ruṇṭē
Kaṭappā ṭaṟinta puṇariya lāṉa.[104g]

இடைப்படிற் குறுகு மிடனுமாருண்டே
கடப்பா டறிந்த புணரிய லான.

"ŭ is further shortened [?] in sandhi and it is dealt with in *Kuṟṟiyalukarappuṇariyal*."

E.g.:
Cukkŭ + kōṭŭ > cukkŭkkōṭŭ

சுக்கு + கோடு > சுக்குக்கோடு.
Cekkŭkkaṇai செக்குக்கணை.

104e. *Tol., Eḻut.*, sūtra 68.
104f. *Tol., Eḻut.*, sūtra 36.
104g. *Tol., Eḻut.*, sūtra, 37.

Tolkāppiyar reveals a very rare insight here in recognising the phoneme *ŭ* which approaches more pointedly to (i.e. 'tends to', mathematically speaking) the conceptual non-linearity!

Īreḻut torumoḻi yuyirttoṭa riṭaittoṭar
Āytat toṭarmoḻi vaṉṟoṭar meṉṟoṭar
Āyiru mūṉṟē yukaraṅ kurukiṭaṉ.[104h]

ஈரெழுத் தொருமொழி யுயிர்த்தொட ரிடைத்தொடர்
ஆய்தத் தொடர்மொழி வன்றொடர் மென்றொடர்
ஆயிரு மூன்றே யுகரங் குறுகிடன்.

"There are only six kinds of words where ŭ is found. They are *Īreḻuttorumoḻi* or words like *நாகு* (nākŭ) or *ஈறு* (īṟŭ) made up (of) two vowel-consonants, or of one long vowel and one vowel-consonant, *uyirttoṭarmoḻi* or words like *வரகு* (varakŭ) or *அரசு* (aracŭ) having a vowel-consonant between the first vowel-consonant or vowel and the last vowel-consonant, *iṭaittoṭarmoḻi* or words like *தெள்கு* (teḻkŭ) or *எள்ளு* (eḻḻŭ) having a semi-vowel [?] between the first vowel-consonant or vowel and the last vowel-consonant, *āytattoṭarmoḻi* or words like *எஃகு* (eःkŭ) or *கஃசு* (kaःcŭ) having an *āytam* between the first vowel or vowel-consonant, *vaṉṟoṭarmoḻi* or words like *கொக்கு* (kokkŭ) or *எட்டு* (eṭṭŭ) having a voiceless consonant between the first vowel-consonant or vowel and the last vowel-consonant and *meṉṟoṭarmoḻi* or words like *தெங்கு* (teṅkŭ) or *எங்கு* (eṅkŭ) having a nasal between the first vowel-consonant or vowel and the last vowel-consonant."[104i]

Avaṟṟuḷ
Īroṟṟuttoṭarmoḻi iṭaittoṭa rākā[104j]

அவற்றுள்
ஈரொற்றுத் தொடர்மொழி யிடைத்தொட ராகா.

"The word which has a semi-vowel following the initial vowel or vowel-consonant and preceding a consonant other than the first part of the final vowel-consonant, cannot be regarded as *iṭaittoṭar*, *[இடைத்தொடர்]*".

E.g.:

Īrkkŭ *ஈர்க்கு.*

104h. *Tol., Eḻut.,* sūtra 407.

104i. The translation is that of P. S. Subrahmanya ŚASTRI, *Tol., Eḻut.,* Vol. 1, Madras Oriental Series No. 3, 1930, pp. 67-68.

Here 'vowel-consonant' obviously denotes a consonant and a vowel as for instance nakŭ *நாகு* is said to have been "made up of two vowel-consonants [!]". The translation *closely* follows the Tamil idiom *Uyirmey* *(உயிர்மெய்)*.

104j. *Tol., Eḻut.,* sūtra 408.

Allatu kiḻappiṉum vēṟṟumaik kaṇṇum
Ellā viṟutiyu mukara niṟaiyum.[104k]

அல்லது கிளப்பினும் வேற்றுமைக் கண்ணும்
எல்லா விறுதியு முகர நிறையும்.

"Both in *non-case-relation sandhi* and in *case-relation sandhi* it (u̇) appears at the end of the above six kinds of words." [cf. *Tol. Eḻut.* Sūtra 407].

It is to be noted that Tolkāppiyar says here that *u̇* is not shortened. It clearly indicates Tolkāppiyar's pointed reference to the differentiation of the non-linear *u̇* from the short *u*. For, when Tolkāppiyar speaks of the retention of the duration of the non-linear *u̇* here, it is obvious that he treats it as entirely different from the short *u* just as he would speak of any other phoneme like *a* or *i* as different from *u*.[104 l]

Valloṟṟut toṭarmoḻi valleḻuttu varuvaḻi
Tollai yiyaṟkai nilaiyalu murittē.[104m]

வல்லொற்றுத் தொடர்மொழி வல்லெழுத்து வருவழி
தொல்லை யியற்கை நிலையலு முரித்தே.

"*u̇* at the end of *valloṟṟuttoṭarmoḻi* may remain as such if the following word commences with a voiceless consonant."

104k. *Tol., Eḻut.*, sūtra 409.
Cf. too in this connection,
Meyyi ṉaḻavē yaraiyeṉa moḻipa.
மெய்யி னளவே யரையென மொழிப.
"The quantity of a consonant is half a mātrā."
(*Tol. Eḻut.*, Sūtra 11).

Avviya ṉilaiyu mēṉai mūṉṟē.
அவ்விய னிலையு மேனை மூன்றே.
"The other three too [the non-linear phonemes] are of the same nature; (i.e.) the quantity of ĭ, *u̇* and ஃ is half a mātra each."
(*Tol., Eḻut.*, sūtra 12).

Tolkāppiyar's clubbing together in the matter of *duration* the consonant and the *non-linear phonemes* reminds one of the analogous *reduction* of the Indian Musical Scale to the *tempered one*, (Cf. J. Murray Barbour, JASA, Vol. 21, pp. 587 ff.) with all the attendant dangers, although it has its own usefulness and a certain seeming convenience and simplicity (!), only as a very rough approximation.

104l. P. S. Subrahmanya Sastri, *Tol., Eḻut.*, with an elaborate Tamil commentary, Trichinopoly, 1937, p. 322.

104m. *Tol., Eḻut.*, sūtra 410.

E.g.:

Kokkŭ + Kaṭitŭ > Kokkŭkkaṭitŭ.
கொக்கு + கடிது > கொக்குக்கடிது.

Kokkŭ + kaṭumai > kokkŭkkaṭumai.
கொக்கு + கடுமை > கொக்குக்கடுமை.

The next sūtra (*Tol.*, *E<u>l</u>ut.*, 411) speaks of the transformation of *ku<u>r</u><u>r</u>iyalŭkaram* into *ku<u>r</u><u>r</u>iyalikaram* in nākŭ + yātŭ > nāk$^{\bar{\imath}}$yātŭ நாகு + யாது > நாகியாது :—

Yakaram varuvaḻi yikaraṅ kuṟukum
Ukarak kiḻavi tuvarat tōṉṟātu.

யகரம் வருவழி யிகரங் குறுகும்
உகரக் கிளவி துவரத் தோன்றாது.

"If the following word commences with *y*, the final *ŭ* of the preceding word is replaced by *ī*, [which is still further reduced (!), i.e. it tends more to our conceptual *non-linearity*.]"

The significance of this sūtra is too obvious. Tolkāppiyar treats the non-linear *ī* as a different phoneme just as he would treat any phoneme like *ā* or *ū* which is different from short *i*. That is why he says so explicitly that the non-linear *ī* is here shortened. This is a positive evidence as against the negative evidence supplied by *Tol.*, *E<u>l</u>ut.*, sūtra 409 quoted above indicating Tolkāppiyar's rare insight in the matter of differentiating non-linear phonemes from linear phonemes.

(b) *The Āytam* :—

It is clear that in the case of *Āytam*, Tolkāppiyar actually considered some kind of articulation with great force in the expulsion of air from the lungs.[105] The three *non-linear phonemes* share a common property, viz., *close juncture*, that is, in actual articulation there is the absence of any interruption in the breath stream between the non-linear phoneme and the neighbouring consonant which serves as the *sufficient condition* for the occurrence of the *non-linear phoneme*.

105. Cf. *Introduction*, p. 91.

(c) *Discussion of Kuṟṟiyalukaram in Collatikāram* :—

In *Collatikāram*, Tolkāppiyar discusses at length the problem of address :—

Avaitām,
I u ai ō eṉṉum iṟuti
Appāl nāṉkē uyartiṇai maruṅkil
Meypporuḷ cuṭṭiya viḷikoḷ peyarē.[106]

அவைதாம்,
இ உ ஐ ஓ என்னும் இறுதி
அப்பால் நான்கே உயர்திணை மருங்கில்
மெய்ப் பொருள் சுட்டிய விளிகொள் பெயரே.

E.g.:
Cuṭarttoṭii ! Kēḷāy.[107] சுடர்த்தொடீஇ ! கேளாய்

Avaṟṟuḷ
Iī ākum, ai āy ākum[108]

அவற்றுள்
இ ஈ ஆகும், ஐ ஆய் ஆகும்.

"There *i* becomes *ī* and *ai* becomes *āy*."

Ōvum uvvum Ēyoṭu civaṇum.[109]

ஓவும் உவ்வும் ஏயொடு சிவணும்.

"Nouns ending in ō and *ů* [are transformed into *ē* (at the end) in the vocative of address]."[109a]

E.g.:
Vēntů — Vēntē ! "Oh king !"
வேந்து — வேந்தே !

Ukarantāṉē kuṟṟiyalukaram.[110]

உகரந்தானே குற்றியலுகரம்.

"The *ů* (referred to in the previous sūtra) is *Kuṟṟiyalukaram*."

106. *Tol. Col.*, sūtra 122, *Nacciṉārkkiṉiyam* ed. by M. V. Venugopala PILLAI, Pavāṉantar Kaḻakam, Vepery, Madras, 1941, p. 132.

107. *Kalittokai* 51, 1. With the commentary of *Nacciṉārkkiṉiyar*, Publishers Kasi Viswanathan CHETTIAR, Caivasiddhanta Association Ltd., Tinneveli, Madras, South India, p. 151.

108. *Tol., Col.,* sūtra 123.

109. *Tol., Col.,* sūtra 124.

109a. The translations in this part of the Monograph are entirely mine. Only for the sake of scientific accuracy and faithfulness to the original text, rectangular and circular brackets are used here.

110. *Tol., Col.,* sūtra 125.

19. *The Common Property of the three Non-Linear Phonemes* :—

According to Tolkāppiyar, the 'place of articulation' for the *non-linear phonemes*, is the same as the consonant which is the *sufficient condition* for their occurrence.

Avaitām
Kuṟṟiyalikaraṅ kuṟṟiyalukara māyta meṉṟa
Muppāṟ puḻḻiyu meḻuttō raṉṉa.[111]

அவைதாம்
குற்றியலிகரங் குற்றியலுகர மாய்த மென்ற
முப்பாற் புள்ளியு மெழுத்தோ ரன்ன.

"The Non-Linear Phonemes are ī, u̇ and the *Āytam* [which are represented by dots (in script)]."[112]

Cārntuvari ṉallatu tamakkiyal pilaveṉat
Tērntu veḷippaṭutta vēṉai mūṉṟun
Tattañ cārpiṟ piṟappoṭu civaṇi
Yotta kāṭciyiṟ ṟammiyal piyalum.[113]

சார்ந்துவரி னல்லது தமக்கியல் பிலவெனத்
தேர்ந்து வெளிப்படுத்த வேனை மூன்றுந்
தத்தஞ் சார்பிற் பிறப்பொடு சிவணி
ஒத்த காட்சியிற் றம்மியல் பியலும்.

"The three *non-linear phonemes* ī, u̇ *and* ஃ have the same 'place of articulation' as the consonant (preceding in the case of ī and u̇ and following in the case of ஃ) [which is the *sufficient condition* for their occurrence]."

Both the *Āytam* and the *Kuṟṟiyalukaram* must have each had six variants, each variant determined by the six different consonants *k*, *c*, *ṭ*, *t*, *p* and *ṟ*, which served as the *sufficient condition* for the occurrence of these two *non-linear phonemes*,[114] (the *Āytam* and the *Kuṟṟiyalukaram*).

From sūtra 101, *Tol.*, *Eḻut.*, it is clear that Tolkāppiyar conceived that both the *Āytam* and the *Kuṟṟiyalukaram* share the characteristics of *k*, *c*, *ṭ*, *t*, *p* and *ṟ*. According to Tolkāppiyar, who may be assigned to the 3rd century B.C., the *linear u* and the *non-linear u̇* were not differentiated by *simple duration*. They were two distinct phonemes even otherwise. But at the time

111. *Tol.*, *Eḻut.*, sūtra 2.
112. Cf. *Introduction*, p. 90 and *Introduction*, footnote 11.
113. *Tol.*, *Eḻut.*, sūtra 101.
114. Cf. P. S. Subrahmanya Śastri, *Tamil Moḻinūl*, Trichy, 1936, p. 51.

when *Naṉṉūl* came to be written, about 1200 A.D., a good deal of confusion arose.

20. *Tolkāppiyar's Clear-cut Distinction between the Linear and Non-Linear Phonemes and the later-day confusion* :—

The author of *Naṉṉūl* assumed the differentiation to be mere duration, and therefore, he clubbed together *aikārakkuṟukkam* and *aukārakkuṟukkam* with the *non-linear* ī and the *non-linear* ù.

Aikārakkuṟukkam and *aukārakkuṟukkam* are differentiated from *ai* and *au* respectively only in their length. They both belong to the category of *linear phonemes*. The classification of these with the *non-linear phoneme Kuṟṟiyalukaram* (ù) is not justifiable.

Uyirmey Yāyta muyiraḷa poṟṟaḷa
Paஃkiya i u ai au maஃkāṉ
Taṉinilai pattuñ cārpeḻut tākum.[115]

உயிர்மெய் யாய்த முயிரள பொற்றள
பஃகிய இ உ ஐ ஔ மஃகான்
தனிநிலை பத்துஞ் சார்பெழுத் தாகும்.

Among the commentators of the descriptive grammars of Tamil, Civañāṉa Muṉivar சிவஞான முனிவர் upholds the view of Tolkāppiyar as against the views propounded by Mayilaiṉātar மயிலைநாதர் (the well-known commentator of *Naṉṉūl*) and Caṅkaranamaccivāyappulavār சங்கர நமச்சிவாயப் புலவர் and the author of *Ilakkaṇa Viḷakkam*.[116] According to the author of *Naṉṉūl* and his followers, the following ten (without any justification, as we have shown above) were classified into one category.

(i) *Āytam.*
(ii) The *non-linear* ī (*Kuṟṟiyalikaram*)
(iii) The *non-linear* ù (*Kuṟṟiyalukaram*)
(iv) to (x) The seven *uyiraḷapeṭais*

The seven *uyiraḷapeṭais* are the (short) phonemes *a*, *i*, *u*, *e*, *o*, *ai* and *au* added to the corresponding long ones for metrical exigencies.

21. *The Aḷapeṭai Phenomenon* :

It is worthwhile to examine the *aḷapeṭai* phenomenon here. Tolkāppiyar distinguishes this phenomenon from the *non-linearity* in phoneme combinations. He draws a refreshing contrast between the two.

115. *Naṉṉūl of Pavaṇantimuṉivar with the commentary of Caṅkaranamaccivāyar*, Ed. 2, 1935, Sūtra 60, p. 34.
116. See P. S. Subrahmanya Śastri, *Tamil Moḻinūl*, pp. 51-2.

Nīṭṭam vēṇṭi ṉavvaḻa puṭaiya
Kūṭṭi yeḻūuta leṉmaṉār pulavar.[117]

நீட்டம் வேண்டி னவ்வளபுடைய
கூட்டி யெழூஉத லென்மனர் புலவர்.

"If extension in articulation is required, then to that extent a phoneme (necessarily short in duration) is to be added — this is the opinion of learned men."

Kuṉṟicai moḻivayi ṉiṉṟicai niṟaikkum
Neṭṭeḻut timpa rotta kuṟṟeḻuttē.[118]

குன்றிசை மொழிவயி னின்றிசை நிறைக்கும்
நெட்டெழுத் திம்ப ரொத்த குற்றெழுத்தே.

"In any speech-form with a preceding short phoneme and ending in a long phoneme, short phonemes of the *same pattern* as the latter are added to complete the melody (in verse especially)"[118a]

E.g.:
Toḻī ii.
தொழீ இஇ
Eeṉa varumuyir meyyī ṟākātu.[119]

எஎன வருமுயிர் மெய்யீறாகாது.

"In a speech-form *e* cannot stand finally if it is preceded by a consonant."

E.g.:
Ē e koṇṭāṉ
ஏ எ கொண்டான்.

Ekara vokaram peyarkkī ṟāka
Muṉṉilai moḻiya veṉmaṉār pulavar
Tēṟṟamuñ ciṟappu malvaḻi yāṉa.[120]

எகர வொகரம் பெயர்க்கீ றாகா
முன்னிலை மொழிய வென்மனர் புலவர்
தேற்றமுஞ் சிறப்பு மல்வழி யான.

117. *Tol., Eḻut.,* sūtra 6.
118. *Tol., Eḻut.,* sūtra 41.
118a. P. S. Subrahmanya Śastri's translation here appears to be misleading. (Cf. Madras Oriental Series, No. 3, 1930, p. 7.) Hence it is abandoned, and the translation given here is my own which attempts to be loyal to the original text of the sūtra.
119. *Tol., Eḻut.,* sūtra 71.
120. *Tol., Eḻut.,* sūtra 273.

"*e* and *o* never occur finally in nouns except when they are used as particles to denote certainty and superiority respectively; *e* and *o* occur finally in the verbs of second person."

The last sūtra presupposes *Tol., Col.*, sūtra 263, which is the following:

Teḻiviṉ ēyum ciṟappin ōvum
Aḻapiṉ eṭutta icaiya eṉpa.

தெளிவின் ஏயும் சிறப்பின் ஓவும்
அளபின் எடுத்த இசைய என்ப.

"In the sense of clarity (and therefore certainty), and in the sense of superiority respectively, even after nouns *ē* and *ō* occur finally."

Tol., Col., Sūtra 259, says that in five contexts (clarity, interrogation, differentiation, denumeration, and the final prosodial position), *ē* occurs.

(i) Certainty:

Unṭ[ē] e maṟumai   உண்டே எ மறுமை.
"There will certainly be rebirth".

(ii) Interrogation:

Niy[ē] uṇṭāy?   நீயே உண்டாய்.
"Did *you* eat?"

(iii) Differentiation:

Avaruḻ ivaṉ[ē] kaḻvan   அவருள் இவனே கள்வன்.
"Among them *he* is the thief."

(iv) Denumeration:

Nilan[ē] nīr[ē] tīy[ē] vaḻiy[ē]   நிலனே நீரே தீயே வளியே.
"Land, water, fire, etc."

(v) Final Prosodial Position:

Kaṭal Pōṟ ṟōṉṟala kāṭiṟan tōr[ē][121]
கடல் போற் றோன்றல் காடிறந்தோரே.

"Resembling the sea, [who forgets those drowned in it], those who have left the forest (too have forgotten us!)" [This is the poetic way of expressing the commonplace adage "out of sight, out of mind!"]

121. *Akanāṉūṟu*, 1:19, Ed. by V. V. Raghava Aiyangar, Madras, p. 4, 1935.

In *Tol., Col.*, 258, likewise we are told about the different contexts where ō occurs :—

Pirinilai viṉāvē etirmaṟai oḻiyicai
Terinilaik kiḻavi ciṟappoṭu tokaii
Irumūṉṟeṉpa ōkā rammē.

பிரிநிலை வினாவே எதிர்மறை ஒழியிசை
தெரிநிலைக் கிளவி சிறப்பொடு தொகைஇ
இருமூன் றென்ப ஓகா ரம்மே.

(i) Discrimination :

Yān[ō] tēṟēṉavar poyvaḻaṅ kalarē.

யானோ தேறேனவர் பொய்வழங் கலரே.

" I am not convinced, for he is not used to lying "[122]

[The lady-love convinced in her mind of the lover keeping his promise of early return at any cause, refuses to accept the seasonal change even when pointed out to her.]

(ii) Question :

Cāttan uṇṭāṉ[ō] ? *சாத்தன் உண்டானோ ?*
" Has Cāttan taken his food " ?

(iii) Contradiction :

Yān[ō] koḻvēn ! *யானோ கொள்வேன் !*
" *Am* I the person to take it " !

(iv) Metrical Exigency :

Koḻal[ō] koṇṭāṉ *கொளலோ கொண்டான்.*

(v) Doubt :

Tirumakaḻ[ō] allaḻ ... ivaḻ yār ? *திருமகளோ அல்லள் ... இவள் யார் ?*
" Who is she ? She is not goddess Lakṣmi ! "

(vi) Superiority :

[Ō]o ! Uvamaṉ uṟaḻviṉṟi ottatē ![123]
ஓ ஒ ! உவமன் உறழ்வின்றி ஒத்ததே !

122. *Kuṟuntokai*, ed., by U. V. Swaminatha IYER, 1937, 21, p. 66.
123. M. V. Venugopala PILLAI's edn. of *Tol., Col.*, Madras, 1941, pp. 276-77.

"Oh, it resembles the absence of hostility of the dumb" (it indicates superiority, the power of the mighty opposition).

[Ē]e yiஃtotta ṉāṇilaṉ ஏ எ யிஃதொத்த ஞணிலன்.
(*Kalittokai*, 62)[124]

"This person is devoid of shame."
(A lady refers here to a seducer)

[Ō]o kaṭalē ஓ ஒ கடலே.
"What a sea!"
(*Kalittokai*, 144)[125]

Though in *Tol., Col.*, 263 *ē* and *ō* are mentioned and not *e* and *o*, but because of *Tol., Eḻut.*, 273, it has to be inferred that *e* and *o* came after *ē* and *ō* in the sense of certainty and superiority respectively.

According to the author of *Tolkāppiyam*, such short phonemes which are added to the long ones are separate distinct entities and they are called by him *aḷapeṭai*; certainly these two phonemes (the long and the added short) do not get compounded into a single extra-long phoneme which is known as *pluta* by Sanskrit grammarians. For, *Tolkāppiyam, Eḻuttatikāram* sūtra 5, denies the existence of three morae sounds.

Mūvaḷa picaittal ōreḻuttiṉṟē
மூவள பிசைத்த லோரெழுத்தின்றே.

"No single phoneme has three morae."[126]

124. Saiva Siddhanta ed., Tinneveli, p. 182, 1938.
125. Saiva Siddhanta ed., p. 451, 1938.
126. In *Tol., Eḻut.*, sūtra 3, we are told that the phonemes *a, i, u, e* and *o* are characterised by *one-mora* duration.

Avaṟṟul.
a i u.
e o veṉṉu mappā laintum.
ōraḷa picaikkuṅ kuṟṟeḻut teṉpa.

அவற்றுள்
அ இ உ
எ ஒ வென்னு மப்பா லைந்தும்
ஓரள பிசைக்குங் குற்றெழுத் தென்ப.

From the next sūtra (*Tol., Eḻut.*, sūtra 4) we similarly learn that *ā, ī, ū, ē, ai, ō* and *au* are long *two-morae* phonemes.

Ā ī ū ē ai.
Ō au veṉṉu mappā lēḻum.
Īraḷa picaikku neṭṭeḻut teṉpa.

ஆ ஈ ஊ ஏ ஐ
ஓ ஔ வென்னு மப்பா லேழும்
ஈரள பிசைக்கு நெட்டெழுத் தென்ப.

It is, therefore, clear that there is no question of *pluta* in *aḻapeṭai* even as the non-linear phoneme *ĭ* and *ŭ* are not the still further shortened linear phonemes *i* and *u*.

While in the case of the *non-linear phonemes,* there is *close juncture* (i.e, absence of any interruption during articulation in the breath stream between each of these and the respective neighbouring consonant phoneme which is the *sufficient condition* for the occurrence of each of these), in *aḻapeṭai* there is *disjuncture* (i.e., separation between the long phoneme and the corresponding short phoneme by an interruption in the breath stream during articulation.).

Tol., Eḻut., sūtra 274 further says that "consonant phoneme (voiceless *k, c, t* or *p*) is not inserted after the particle *e* (denoting certainty) and *o* (denoting superiority)."

Tēṟṟa vekaramuñ ciṟappi ṉovvu
Mēṟkū ṟiyaṟkai valleḻut tumikā.

தேற்ற வெகரமுஞ் சிறப்பி னொவ்வும்
மேற்கூ றியற்கை வல்லெழுத்துமிகா.

E.g.:
Yāṉē e koṇṭēṉ யானே எ கொண்டேன்
Avanō o koṇṭāṉ அவனோ ஒ கொண்டான்

But in the case of verbs of second person, an additional consonant phoneme occurs. There is, in other words, doubling of the consonant.

E.g.:
Ē ek koṟṟā ஏ எக் கொற்று
Ō ok koṟṟā ஓ ஒக் கொற்று.

These forms seem to have been used in Old Tamil respectively in the sence of "do a particular work for me" and "desist from doing this."[127]

Again *Tol., Eḻut.,* 278, says that before *k, c, t* or *p,* there is *e* added after the final *ē.*

Ēye ṉiṟutikkekaram varumē:
ஏயெ னிறுதிக் கெகரம் வருமே.

E.g.:
Ē e k koṭṭil ஏ எ க் கொட்டில்

127. *Tol., Eḻut.,* edited by Kanaka Sundaram Pillai, 2nd ed., South India Saiva Siddhānta Society Publication No. 17, Madras, 1933, p. 174.

In sūtra 291 of *Eluttatikāram*, Tolkāppiyar says that there is no change in sandhi if the preceding word ends in ō and denotes contradiction, interrogation or doubt.

Māṟuko ḻeccamum viṉāvu maiyamum
Kūṟiya valleḻut tiyaṟkai yākum.

மாறுகொ ளெச்சமும் வினவு மையமும்
கூறிய வல்லெழுத் தியற்கை யாகும்.

E.g.:

Yāṉ[ō] koṇṭēṉ ? *யானோ கொண்டேன்?*
"Did I possess ?" (indicating the opposite).

Nīy[ō] koṇṭāy ? *நீயோ கொண்டாய் ?*
"Did you possess ?" (interrogation)

Patt[ō] patiṉoṉr[ō] *பத்தோ பதினொன்றோ.*
"Ten or Eleven" (doubt).

Here we may profitably compare *Tol., Eḻut.*, sūtra 276 :

Māṟuko ḻeccamum viṉāvu meṇṇuṅ
Kūṟiya valleḻut tiyaṟkai yākum.

மாறுகொ ளெச்சமும் வினவு மெண்ணுங்
கூறிய வல்லெழுத் தியற்கை யாகும்.

"There is no change in sandhi if *k, c, t* or *p* follows ē when the latter denotes negation, question or number.

E.g.:

Yāṉē koṇṭēṉ *யானே கொண்டேன்*
Nīyē koṇṭāy *நீயே கொண்டாய்*
Koṟṟaṉē cāttaṉē *கொற்றனே சாத்தனே.*

In sūtra 292 (*Eḻuttatikāram*), we are told that there is no change also when ō is *oḻiyicai*, i.e., suggests something that is left out.

Oḻintata nilaiyu moḻintavar ṟiyaṟṟē.
ஒழிந்தத நிலையு மொழிந்தவற் றியற்றே.

E.g.:

Koḷalō koṇṭāṉ *கொளலோ கொண்டான்.*

In the sutra following[128] we are still further told that the *case-relation sandhi* when the preceding word ends in ō is same as when it ends in ē (i.e., a voiceless consonant is inserted and *o* follows ō).

vē<u>r</u><u>r</u>umaik kaṇṇu mata<u>n</u>ō ra<u>r</u><u>r</u>ē
Okaram varuta lāvayi <u>n</u>ā<u>n</u>a.

வேற்றுமைக் கண்ணு மதனோ ரற்றே
ஒகரம் வருத லாவயி னான.

E.g.:

Ō o k kaṭumai ஓ ஒக்கடுமை
"How terrible!"

In *sūtra* 227 of *Tol., E<u>l</u>ut.,* also we are informed that *a* occurs after a word ending in *ā* with a short vowel in the previous syllable.

Ku<u>r</u>iyata<u>n</u> mu<u>n</u><u>n</u>aru mōre<u>l</u>uttu mo<u>l</u>ikkum
A<u>r</u>iyat tō<u>n</u><u>r</u>u makarak ki<u>l</u>avi.

குறியதன் முன்னரு மோரெழுத்து மொழிக்கும்
அறியத் தோன்று மகரக் கிளவி.

E.g.:

Palā a k kōṭu பலா அ க் கோடு.
(< Palā + kōṭu; பலா + கோடு).

Kā a k ku<u>r</u>ai கா அக்குறை
(< Kā + ku<u>r</u>ai; கா + குறை).

It is *significant* that in this sūtra, Tolkāppiyar speaks of *syllabic-phonemes* (*ōre<u>l</u>uttu mo<u>l</u>i*).

It is definite that *e<u>l</u>uttu* in Tolkāppiyam signifies a *sound-class* (*phoneme*). The *syllabic phonemes* are short, we meet with in French *ici* here [*i-'t ' i*] *uí today* ['ɥi].[129]

In *Collatikāram* (*Morphology*) too, Tolkāppiyar discusses *a<u>l</u>apeṭai.*

A<u>l</u>apeṭai mikūum ikara i<u>r</u>upeyar
Iya<u>r</u>kaiya ākum ceya<u>r</u>kaiya e<u>n</u>pa.[130]

அளபெடை மிகூஉம் இகர இறுபெயர்
இயற்கைய ஆகும் செயற்கைய என்ப.

128. *Tol., E<u>l</u>ut.,* 293.
129. Vide Robert A. HALL, Old French Phonemes and Orthography, *Studies in Philology,* Vol. 43, 1946, p. 578 (3·1).
130. *Tol., Col.,* 127.

According to *Uraiyāciriyar* (one of the commentators of *Tolkāppiyam*), if *aḻapeṭai i* ends finally, very naturally (*iyaṟkaiya*) it will take vocative. By the word *ceyaṟkaiya* (artificially) he takes to mean that there are two sets of people who represent this phenomenon in writing by assigning 3 and 5 morae respectively. This view appears to be most tenable in the light of the language of the *sūtra* itself.[131]

Both Cēnāvaraiyar and Naccinārkkiniyar (two other commentators of *Tolkāppiyam*) confuse the issue by considering the *aḻpeṭai* phenomenon in the aggregate such as *āa* (or *īi*) as a single *Unitary phoneme*. This is obviously an error, and it was never intended by the author of *Tolkāppiyam* according to whom it is clear that only the short *a* (or *i*) added as a separate phoneme to the long *ā* (or *ī*) was to be called *aḻapeṭai*.

E.g.:
Toḻī ii[132] தொழீ இஇ
"Oh woman, who has got the function of seeing!"

It is very *significant* that the author of *Tolkāppiyam* in *Collatikāram* refers *distinctly* to *Kuṟṟiyalukaram* (the *non-linear phoneme ŭ*) laying emphasis on its true status in sūtras 124 and 125, while in sūtra 127 he refers to the *aḻapetai* phenomenon.

Ōvum uvvum ēyoṭṭu civaṇum[133]
ஓவும் உவ்வும் ஏயொடு சிவணும்.

"Nouns ending in *ō* and *u* are transformed with *ē* ending in the vocative of address."[134]

Mitiyaṟ ceruppiṟ pūḻiyar kōvē[135]
மிதியற் செருப்பிற் பூழியர் கோவே.
"Oh! the king of the mountains called *ceruppu*!"

Here there is a play on the word *ceruppu* which literally means 'footwear'. *Mitiyal* means 'not a footwear'. It is an adjunct to *ceruppu*. The idea is that *ceruppu* here indicates a mountain, being its proper name and not a footwear.[136]

131. Cf. P. S. Subrahmanya Śastri, *Tol., Col., Kuṟippu*, p. 122, 1930.
132. *Kalittokai* 103, line 40, p. 316.
133. *Tol., Col.*, 124.
134. The numbering of these sūtras is as in M. V. Venugopala Pillai's edition of *Tol., Col.*, Madras, 1941, pp. 133–4.
135. U. V. Swaminatha Iyer's edn. of *Patiṟṟuppattu*, 3rd *pattu*, (21), line 23, p. 24 (1920).
136. *Ibid.*, p. 26.

Paṭaiyē rul̲ava pāṭin̲i vēntē
Yilaṅkumaṇi miṭainta polaṅkalat tikirik
Kaṭalaka varaippin̲ip pol̲in̲mul̲u tāṇṭanin̲
Mun̲r̲iṇai mutalvar pōla nin̲r̲u nī
Keṭā a nallicai nilai it
Tavā a liyarōviv vulakamō ṭuṭan̲ē.[137]

படையே ருழவ பாடினி வேந்தே
யிலங்குமணி மிடைந்த பொலங்கலத் திகிரிக்
கடலக வரைப்பினிப் பொழின்முழு தாண்டநின்
முன்றிணை முதல்வர் போல நின்று நீ
கெடா அ நல்லிசை நிலை இத்
தவா அ லியரோவிவ் வுலகமோ டுடனே.

That the *ú* referred to in the sūtra *Tol., Col.,* 124 is *Kur̲r̲iyalukaram* is specially emphasised by Tolkāppiyar in the very next sūtra *Tol., Col.,* 125. The significance of this emphasis is quite clear. Tolkāppiyar distinguishes the *non-linear phonemes* ī and *ú* from the *linear phonemes* in the phenomenon known as *al̲apeṭai* (for instance, short *i* added to long ī for reasons like metrical exigency and emotional emphasis).

Tolkāppiyam Porul̲atikāram[138] sūtra 325 further says that it is possible that *al̲apeṭai* comes also for rhythm.

Al̲apeṭai yacainilai yākalu murittē.
அளபெடை யசைநிலை யாகலு முரித்தே.

E.g.:

Kaṭā 'unsuspicious' as in the following.

Kaṭā a vuruvoṭu kaṇṇañcā tiyāṇṭu
Mukāamai vallatē yor̲r̲u.[139]

கடா அ வுருவொடு கண்ணஞ்சா தியாண்டு
முகாஅமை வல்லதே யொற்று.

"He alone is the proper spy who dresses in a suitable form which does not arouse suspicion, and who faces boldly those who suspect him, and who does not betray his cause under any circumstances."

137. *Patir̲r̲uppattu,* 2nd *pattu,* (14), lines 17-22, p. 8.
138. Edited by Chidambaram Pillai and S. Vaiyapuri Pillai, p. 362, Madras 1935.
139. *Tirukkur̲al̲,* 585 with the commentary of Parimēlal̲akar, Publishers Ratna Naikar and Sons, Madras, 1937, p. 347.

22. *Conclusion* :—

In short, the phenomenon where a short *u* and short *i* follow respectively the long *ū* and the long *ī* is known as *aḻapeṭai*. This does *not* have the same status as the *kuṟṟiyalikaram* (*i̇*) and the *kuṟṟiyalukaram* (*u̇*) which are obviously *non-linear phonemes* and whose status is that of the most interesting *non-linear phoneme Āytam*.[140] When the short *i* or the short *u* follow the long *ī* or long *ū*, there is only *linearity* of the *phoneme-combinations* in the stream of speech.

We have so far examined in some detail the great descriptive grammar *Tolkāppiyam* in the light of modern phonemics. We are lost in wonder that in this Old Tamil grammar, we rediscover, as it were, many of our own modern ideas. The conviction is gained more and more that it is worth the while to subject *Tolkāppiyam* to a detailed scrutiny exploiting this beautiful work from the rigorous view-point of modern Phonemics.

140. Cf. *Tol.*, *Eḻut.*, sūtra 2; see also P. S. Subrahmanya Śastri, *Tol.*, *Eḻut.*, *Kuṟippuraiyuṭan*, 1937, under sūtra 101, p. 103.

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